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Contents.

	PAGE
British Foundry Equipment in British Dominions	273
Correspondence	274
I.B.F. Notes	274
The Franco-Belgian Foundry Congress	274
The Influence of Rate of Cooling and Casting Temperature on Cast Iron	275
Moisture and Moulds	279
60-K.V.A. Electric Resistance Furnace	280
Curing a Dusty Concrete Floor	281
Corrosion and Alloy Steels	281
The Selling of Castings—XIX	282
Notes on Receiving Castings	283
New Direct Process for the Manufacture of Steel	284
Protective Castings for Steel	285
Complimentary Dinner to Mr. Moore	286
Trade Talk	290
Contracts Open	290
Company News	290
Personal	290
Iron and Steel Markets	292

Forthcoming Events.

OCTOBER 2-17.

Textile Machinery and Accessories Exhibition at Manchester.

OCTOBER 3.

Institute of British Foundrymen (Lancashire Branch):—Presidential address by J. Masters at Manchester.

OCTOBER 6.

Institution of Automobile Engineers:—Presidential address by H. Kerr Thomas, "The Automobile Engineer," in London.

Sheffield Metallurgical Association:—Ordinary meeting at Sheffield. "The Hardness of Steel," Paper by W. H. Hatfield.

Institute of Metals (Birmingham Local Section):—Ordinary meeting at Birmingham. "Some Phases of Life in India," Paper by F. Johnson, D.Sc.

Institute of Metals (North-East Coast Local Section):—Meeting at Newcastle-on-Tyne. Chairman's address by H. J. Young, F.I.C.

Institution of Heating and Ventilating Engineers:—Ordinary meeting in London. "Practical Measurement of Air Flow." Paper by E. Ower.

Society of Model and Experimental Engineers:—Ordinary meeting in London. "The Railway Centenary," Paper by E. A. Forward

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.

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Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

Foundry Trades Equipment & Supplies Association.
Secretary: K. S. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

British Foundry Equipment in British Dominions.

Both Mr. Arthur Moore, the managing director of the Standard Brass Company, Benoni, South Africa, and Mr. W. O'Keefe, an Australian established in business in this country, speaking at a dinner arranged in honour of the former last Thursday, expressed views on the marketing of foundry equipment and supplies in the Dominions which should be carefully studied by all who have inter-Empire business at heart. They are printed elsewhere in this issue. So far as South Africa and India are concerned, the major problem is that of introducing devices and material capable of increasing the output of the skilled man, but common labour being so cheap, no labour-saving device, unless of a wholesale character, has much of a market. In Australia and Canada, however, all types of labour-saving devices are required.

It was pointed out that owing to immense distances agents could not be expected to send out travellers to sell just one type or a range of machines, as travelling expenses alone would preclude any chance of profitable business. Mr. O'Keefe suggested that to do any real business one man would have to represent a group of firms who may perhaps be competitive so far as Great Britain is concerned, and the participants would have to rely on the agent's honesty to sell the best machine or material in any particular foundry according to his judgment and experience. Now as these trades possess their own organisation—the Foundry Equipment and Supplies Association—we suggest they should make an experimental attack on one Dominion, and if success is achieved or promise shown, follow it up by further campaigns. It is patent that, rare cases excepted, they cannot afford exclusive representation, and a co-operative selling scheme is the sole means available for introducing the goods to the Dominions. The trade done hitherto has not been an extensive one, and is probably less than America can show. In the past there has been far too much competition and far too little co-operation, and to-day not an inconsiderable business is done between British foundries and foreign equipment suppliers. We are not unduly concerned on this score, as the more machines we instal the cheaper the product will be and the greater the general buying capacity of the industry, providing the whole of the benefits are not given to the buyer. The home equipment concerns are bound to have their share of this, and a larger market should enable them to develop new and better machines. It is conceivable that in time the Dominions' market will be equally as large as the home one, and a pioneering attempt to capture them is certain to bear fruit.

We hope that the members of the Foundry Supplies and Equipment Association will in the near future pool first their experiences in this direction and then their resources for the extension of their overseas business.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

The Offering of Foreign Foundry Plant in Great Britain.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Your leader in this week's issue is interesting. Your remarks on the discussion as to whether exhibits of German origin should be included in the exhibition to be held in June next, at the Agricultural Hall, in London, I think are answered by your article as a whole.

As specialists and manufacturers of foundry equipment, my company welcome anybody and everybody. It is only by these means real progress can be maintained.—Yours, etc.,

HARRY J. COGGON.

Savile Mount,
49, Savile Park Road, Halifax.

Heat-Resisting Cast Iron.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR, Your issue of September 17 contains Mons. Levi's reply to the criticisms on his Paper given at the annual Convention at Glasgow. Therein he states that unless his memory fails him I have given a formula which, with 3 per cent. total carbon, calls for a silicon content of 2 to 2.25 per cent. for Diesel engine pistons.

Either his memory *has* failed him or he has failed to read the formula correctly. The formula referred to reads:—

$$\frac{C}{4.26 - \frac{C}{3.6}} Si = 0.76 \text{ to } 0.82 \text{ for Diesel pistons.}$$

This calls for a silicon content of not more than half the amount Mons. Levi works it out to be, which is further evidence that though he presented an admirable *resumé* of the work published on the subject he chose for his Paper, he has quite failed to appreciate the lessons it contained.—Yours, etc.,

F. J. COOK.

Birmingham.

Patent Specifications.

Particulars of complete specifications accepted, furnished by Mr. Eric Potter, Patent Agent, of Lonsdale Chambers, 27, Chancery Lane, London, W.C.2. Printed copies of the specifications in the following list are now on sale.

239,649. SMITH, W. S. and BROOKFIELD. Cupolas and like furnaces.

239,654. BURGERS, F. Treatment of pig or crude iron.

239,720. BROWN, L. VENN. Extraction of metals from their ores.

239,785. WALFORD, E. W., and HOLLEY, G. M. Method of protecting the surface of metal moulds and apparatus therefor.

I.B.F. Notes.

Newcastle Junior Section.

Members of the Newcastle Junior Section spent a very enjoyable evening on Wednesday, September 23, when they were the guests of Mr. and Mrs. M. E. Gallon at a dance held in the Lecture Hall, Dunston-on-Tyne.

Mr. and Mrs. Gallon have shown great interest in the welfare of the Junior Section since its formation, and the members are indebted to them for their kindness on this and other occasions.

Steel pipes, which during the war carried water across the desert for our troops in Palestine, will be used by the Associated Portland Cement Manufacturers in their works reconstruction scheme at Northfleet, on the Thames. The pipes will serve as the slurry mains, for conveying the liquid cement to the kilns.

The Franco-Belgian Foundry Congress.

The Joint Meeting of the French and Belgian Foundrymen's Association, which is due to be held from Sunday, October 25, to October 28, at Liège, in the buildings of the Association des Ingenieurs, 16, Quai des Etets Unis, is to receive some very interesting papers. The following are assured (on behalf of the French Association): "The Manufacture of Nickel-Manganese Brass," by Le Thomas (Indret); New Methods of Testing Cast Iron," by Le Thomas (Indret); "Cobalt Additions," by Albert Levasseur (Paris); "High Tensile Brass," by Mr. Thebaud (Paris); "Some Characteristics of Foundry Irons," by J. H. Fleming; "Designing Steel Castings for obtaining Economics," by Nestor Leonard (Feignes); "Standardisation of the Testing of Cast Iron," by Mr. Augustin Planas (Madrid); "Comparative results obtained from the Firmint and Standard Methods for Testing Cast Iron," by Joaquin Ferrer (Saragossa); "Spanish-Portuguese Moulding Sands," by Ricardo Ituarte (Paris); "Foundry Technical Terms in French, Spanish and Portuguese," by J. M. Espana (Paris); "American and Canadian Methods for the Manufacture of Railway Car and Locomotive Bearings" (American Exchange Paper), by G. H. Clamer (past-president American Foundrymen's Association); "Progress in Cast-Iron Research in Great Britain" (British Exchange Paper), by J. G. Pearce (Director B.C.I.R.A.). On behalf of the Belgian Foundrymen's Association: "Foundry Practice," by Mr. de Fleury (Brussels); "Centrifugal Castings" (British Exchange Patent), by J. E. Hurst (Kilmarnock); "Contraction and Blowholes," by J. Leonard (Angleur); "Notes on Organisation," by J. Leonard (Angleur); "The Manufacture and Quality of Steel Castings," by O. Mennier (Seraing); "The Nature of Metals," by Prof. Trasenter (Liège).

Catalogues Received.

Files.—The Hardy Patent Pick Company, Limited, of Sheffield, are using a large-sized mailing card as a means of publicity for "Hardy's" Files. It is available for any foundryman on application.

Malleable Iron Fittings.—We have received from F. A. Welling & Company, Limited, of 10, Lime Street, London, E.C.3, a four-page price list of malleable iron tube fittings made by the National Malleable Company, Limited, of Guelph, Ontario, Canada.

Automatic Temperature Regulators.—The Cambridge Scientific Instrument Company, Limited, of 45, Grosvenor Place, London, S.W.1, are using an illustrated mailing card to bring to the notice of foundry owners their list No. W150, which deals with the automatic regulation of furnace temperatures.

Steam-Roller Water Sprayer.—Messrs. W. E. Horsman, Son & Company, of Eveline Road, Mitcham, Surrey, have sent us a folder illustrating and describing "Van Putten's Roller Water Sprayer," and the "Multi-Rapid Screening Machine."

Hydraulic Presses.—Messrs. Hollings & Guest, Limited, of Thimble Mill, Birmingham, have sent us a catalogue which is of definite interest to all foundrymen. It describes and illustrates *inter alia* hydraulic pig-breakers and scrap-bundling presses. In connection with the latter, a briquetting machine for cast-iron borings is described. The catalogue contains twelve pages, and is printed in two colours on art paper.

Lapping Machines.—We have received from Messrs. Bethel, Player & Company, Limited, of 17, Philpot Lane, London, E.C.3, an eight-page catalogue describing and illustrating the machines they handle for the Bethel Player Company, of Westboro', Mass., U.S.A.

Oil Testers.—Sir W. H. Bailey & Company, Limited, of Albion Works, Manchester, are to be congratulated on the new catalogue bearing the title "Oil Testers." Apart from describing and illustrating their apparatus, it contains much of real technical interest.

The Influence of Rate of Cooling and Casting Temperature on Cast Iron.

By Our Metallurgical Correspondent.

The final constitution of cast iron and the relative quantities of the various constituents present is influenced very considerably by the rate of cooling. The uniform composition of the silico-austenite solid solution deposited during solidification, the completeness of the transformations indicated in the constitutional diagrams, in the solid alloys are largely dependent on the rate of cooling of the material through these ranges. The extent of the precipitation of graphite in a cast iron of a given composition in a like manner is dependent on the rate of cooling. All the evidence shows that providing the rate of cooling is sufficiently slow the pure iron carbon alloys and all commercial cast irons deposit the whole of their carbon contents in the form of graphite, and with the variety of rates of cooling met with in daily practice various proportions of graphite are precipitated.

The completeness of all these changes affect the mechanical and physical properties of cast iron, particularly the extent of the graphite formation, which has a profound influence on the shrinkage, hardness and machinability and also the mechanical strength properties.

In addition to its influence on the completeness or otherwise of the constitutional changes taking place during the cooling of cast iron the crystalline structure itself is also influenced by the rate of cooling. It is a well-known general law that the slower the rate of cooling the larger the size of the crystalline grains, and *vice versa*. The crystalline structure from this point of view is independent of the constitutional changes which take place during cooling, and the constitutional diagram is no guide to the structure of the alloy. The structure of the alloy is of vast importance in determining the mechanical and physical properties. Therefore, by reason of its influence on both the constitutional changes and the crystal structure the study of the influence of the rate of cooling is one of fundamental importance in the study of the metallurgy of cast iron.

The common method amongst foundrymen in comparing the rate of cooling is to consider the rate of cooling in some manner proportional to the thickness of the castings. It will be seen at once on reflection that this is generally by no means sufficient. The rate of cooling is influenced by the initial temperature of the material, the temperature of the surroundings, the surface area exposed to the surroundings in addition to the mass of the material and its thickness. There is a grave danger in the common conception of imagining that some simple linear relationship exists between the rate of cooling and the cross-sectional dimensions. This is not true, although in general foundry practice the use of the cross-sectional dimensions as a rough comparison of cooling rates is legitimate providing its limitations are thoroughly understood and appreciated.

If we imagine a body, say, a large ingot of cast iron, cooling from some temperature, a cooling curve can be constructed from the observations of the temperature at given intervals of time at any given point within the body. Such a cooling curve when plotted will be a sloping curve of the type illustrated in Fig. 1 with certain arrests depending upon the physical changes and transformations passed through during cooling. Neglecting the arrest points the slope of this curve or the number of degrees temperature passed through in unit time is the rate of cooling. It will be seen from the curve, Fig. 1, which is a typical cooling curve of cast iron, that the slope of the curve varies very considerably throughout the duration of the cooling. In the early stages the slope is steep, indicating a quick rate of cooling; at other portions of the curve the slope becomes less steep, indicating a slowing up in the rate of cooling. If we imagine cooling curves taken at various points from the outside edge towards the centre of the imaginary ingot we shall find the cooling curves will vary according to the position at which they are taken. A diagrammatic representation of four curves taken at equidistant spaces apart in the imaginary ingot from the outside surface is illustrated in Fig. 1. The closer the curve is taken towards the outside edge the steeper the slopes in the curve, and the greater the rate of cooling. The slopes become less steep and the rates of cooling slower as we approach the centre of the mass. The variation in the rate of cooling across the section of the ingot is still more clearly represented by plotting the actual rate of cooling at any instant at the particular point within the mass against time. A series of such curves are illustrated in Fig. 2. Neglecting the transformation points the curve A is the variation in rate of cooling at a point 3 mms. under the surface of the ingot. Following this curve, at the commencement of the cooling the actual rate of cooling is nil, and the curve commences from the zero line and rapidly reaches a maximum value passing which the value gradually falls away in the manner indicated. At a point further removed from the surface the rate of cooling in a like manner approaches a maximum value which is considerably less in magnitude and occurs naturally at a later time.

The effect of thermal arrests due to transformations is, of course, omitted in these curves. The evolution of heat occasioned by these transformations causes a slowing of the rate of cooling due to the evolved heat, more or less counterbalancing the heat lost by cooling. The effect of this may be such as to reduce the value of the rate of

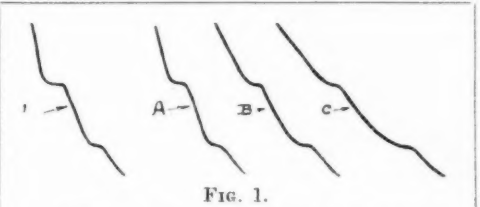

Fig. 1.

I = Ordinary cooling curve; A = Cooling curve at a position near outside edge; B = Cooling curve at a position near centre; and C = Cooling curve at a position nearer centre.

cooling to nothing for a period of time, and their duration depends on the character of the transformation. In point of time the thermal arrests are delayed with respect to one another at consecutive points across the section of the cooling mass. An imaginary arrest has been added in Fig. 2.

The completeness of the transformation is determined by the duration of the arrest; the longer the duration the greater the opportunity for the particular change taking place to completion. The duration of the arrest is determined by the rate of abstraction of heat from the material under the conditions of cooling, so that the rate of cooling immediately preceding the arrest is an index of the rate of abstraction of heat and consequently the duration of the arrest.

We have now to consider the conditions which influence the rate of cooling and the manner in which this influence affects the rate of cooling. In order to simplify the consideration we will consider the imaginary ingot of liquid iron and consider the heat flow under conditions of cooling in a horizontal plane section of this ingot only. By this means the complications of spacial co-ordinates are eliminated. In considering the rate of cooling we have to consider this as a function of the time and of the depth in the metal.

If we imagine this ingot at a certain temperature, and its outside surface suddenly cooled in an infinitesimally short space of time to a given temperature, the curves in Fig. 2 (neglecting transformations) indicate the variation in the rate of

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cooling at various depths within the ingot. Under these conditions the curves can be calculated from the fundamental conductivity equations, and it can be shown that the rate of cooling at any time and at any depth is directly proportional to the difference in temperature between the initial temperature and the final temperature.

The greater the difference in temperature the greater the rate of cooling at any one point at any time. Broadly speaking, under all conditions of sand casting the final temperature may be considered constant, and the difference in temperature will be proportioned to the variation in casting temperature. The higher the casting temperature the greater this temperature difference, and, consequently, the greater the rate of cooling at all points and times throughout and in cooling down of the molten mass.

The conditions above mentioned necessitate the instantaneous cooling of the outer surface of the ingot to the predetermined temperature and its maintenance at this temperature. Mathematically instantaneous cooling of this nature is not obtained in practice, and in sand casting the conditions are very far removed from these. The transference of

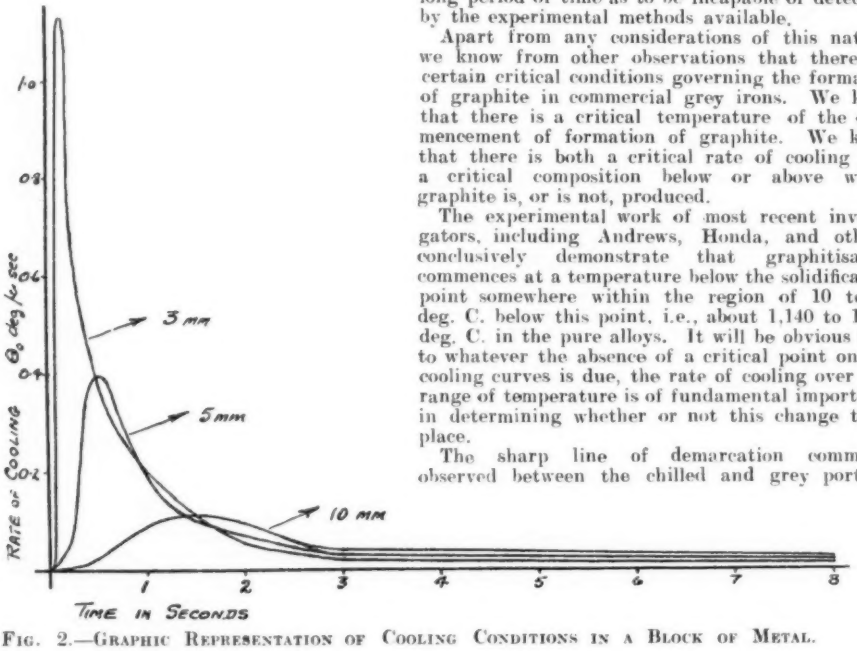

FIG. 2.—GRAPHIC REPRESENTATION OF COOLING CONDITIONS IN A BLOCK OF METAL.

heat from the cooling mass and the rapidity of transference depend upon the thermal conductivity of the mould walls, and in the case of *solid* mould walls the temperature is constantly rising. The effect of the constant rise in temperature of the mould walls will mean a constant and steady reduction in the temperature difference which will effect a constant slowing up of the rates of cooling throughout the mass. The slow extraction of heat due to the low thermal conductivity of sand moulds will also have a profound effect in slowing up the rates of cooling throughout the mass. A simple device to enable the effect of these conditions to be more readily understood is to transpose the curves in Fig. 2. The curves for 3 mms. depth might be omitted, and the curve for 1 cm. depth might be a plausible representation of the ratio of cooling at a depth of 3 mms. under sand casting conditions. The curves then show that the true effect of sand casting on the rate of cooling, in addition to slowing up the mean rate of cooling, is to reduce the rate of cooling gradient at any one time across the section of the bar. The influence of the casting temperature on the temperature difference and on the rate of cooling remains the same.

Cooling in metal moulds having a higher thermal conductivity represents an intermediate stage between the sand casting and the instantaneous chilling, and increases the rate of cooling gradient across the section. The effect of raising the temperature of metal moulds and maintaining the casting temperature constant has the effect of reducing the temperature difference, and hence the rate of cooling at all times and points, but it does not affect the magnitude of the rate of cooling gradient.

Rate of Cooling and Graphitisation.

The principal transformation in which we are interested in commercial cast iron is the formation of graphite. The absence of any critical point on the cooling curves corresponding to the formation of graphite in iron-carbon alloys largely obscures the formulation of the theory of this phenomenon. If the graphite originates from the dissociation of the cementite we should expect this reaction to be endothermic. Under these circumstances an arrest point of the ordinary type would not be expected, as the reaction would absorb heat, causing an increase in the rate of cooling. On the other hand, if the graphite is deposited from the saturated austenite, it is highly probable that this reaction would be exothermic, and, if this is the case, since no arrest point is recorded, the heat liberated must either be of so small a magnitude or extended over such a long period of time as to be incapable of detection by the experimental methods available.

Apart from any considerations of this nature, we know from other observations that there are certain critical conditions governing the formation of graphite in commercial grey irons. We know that there is a critical temperature of the commencement of formation of graphite. We know that there is both a critical rate of cooling and a critical composition below or above which graphite is, or is not, produced.

The experimental work of most recent investigators, including Andrews, Honda, and others, conclusively demonstrate that graphitisation commences at a temperature below the solidification point somewhere within the region of 10 to 50 deg. C. below this point, i.e., about 1,140 to 1,100 deg. C. in the pure alloys. It will be obvious that to whatever the absence of a critical point on the cooling curves is due, the rate of cooling over this range of temperature is of fundamental importance in determining whether or not this change takes place.

The sharp line of demarcation commonly observed between the chilled and grey portions of a chilled casting is evidence of the existence of a critical condition of rate of cooling in a cast iron of given composition at which graphitisation commences. It is a fact that the sharpness of the line of demarcation between the chilled and grey portions in chilled castings is affected by the composition, and the junction is more clearly marked in the case of phosphoric irons than in hematites. The lower the phosphorus the more gradual the change from the white to the graphitic structure. In spite of this there is obviously some point in the cross section of such castings beyond which graphite makes its appearance, indicating that the rate of cooling conditions are such as to allow the graphite to form.

The experiment of Hatfield*, in which a series of test bars 1 in. by ¾ in. in section containing gradually increasing quantities of silicon clearly illustrate the existence of a critical percentage of silicon determining the commencement of graphitisation. These bars were all cast at normal temperatures, and other conditions maintained strictly comparable. Two series were cast, series A and B, series B being cast much hotter than series A. The results of these tests and the graphite contents replotted against the silicon contents have been added in the diagram Fig. 3. The values plotted from an entirely different series of experiments by Hague and Turner † have

* J.I.S.I., No. 2, 1906.
† J.I.S.I.

also been added on Fig. 3, and serve to give additional evidence of the existence of this critical composition of silicon at which graphitisation commences.

As would be expected, this critical percentage of silicon varies under different conditions. The mean rate of cooling in the Hatfield bars $\frac{3}{8}$ in. thick is quicker than in the 1 in. sq. bars of Hague and Turner, and in the quicker rate of cooling the critical silicon percentage is higher than in the lower rate of cooling. In a like manner the higher initial casting temperature is responsible for raising the critical percentage of silicon, other conditions being constant. It would also be expected that variation in the presence of other elements would affect the value of this critical percentage of silicon according to their known influence on the graphitisation phenomenon. For example, other conditions being maintained constant, an increase in sulphur content will raise the value of this critical percentage, and an increase in manganese under ordinary conditions would lower the critical percentage of silicon at which graphitisation commences.

If we consider these critical conditions as a whole, accepting the critical temperature range of the formation of graphite as lying between 1,100 deg. and 1,145 deg. C., in a cast iron of a given chemical composition the critical rate of cooling

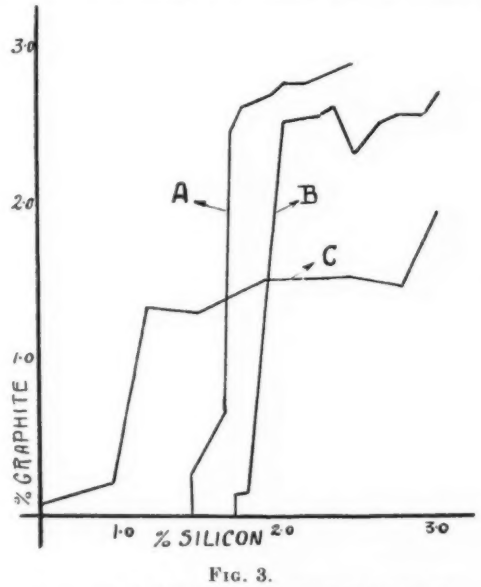

FIG. 3.

Curve A = Hatfield Series A; Curve B = Hatfield Series B; and Curve C = Hague and Turner.

at which the formation of graphite takes place "en masse" as indicated will be the rate of cooling in existence at any point within the mass of iron at the point of time passing through this temperature range. This rate of cooling will determine the time taken in cooling through this critical range which is the feature determining the effectiveness of the graphitisation.

It has been pointed out earlier that the rate of cooling at various points advancing from the outside surface to the centre of the cross section of a mass of cooling metal is not a constant value nor is the rate of cooling at any one of these points constant throughout the whole range of cooling at all times and temperatures. As a matter of fact, the rate of cooling value at any given temperature, say the critical graphitisation temperature, successively attained at various points across the section of the cooling mass, becomes slower within limits the more nearly the centre of the bar is approached. In other words, the rate of cooling is retarded as the centre of the mass is approached. For this reason in a cast iron of a given composition the critical rate of cooling at which graphitisation takes place may not occur until at some point within the mass of the specimen. Under these conditions a chilled zone exists round the graphitised centre. The small traces of graphite in the low silicon numbers of both the Hatfield and the Hague and Turner series may be explained on this basis. This graphite would probably exist in the centres of the bars only and would not be uniformly distributed through the mass. As would be expected in the thicker bars, the graphite makes its appearance in this manner in the lower silicon members of the series at an earlier stages than in the thinner bars.

Rate of Cooling and Dissolved Gases.

Our knowledge of the influence and behaviour of dissolved gases is not very great, but we do know that considerable quantities of dissolved gases exist in cast iron and that a large portion of these are evolved on the change from the liquid to the solid state and during cooling down. In the solidification of the majority of ordinary castings the only available exit of these evolved gases is through the interior mass of liquid metal. It is very obvious that the rate of cooling at the solidification period, determining the time available and the freedom of exit of these gases, if the time available is not sufficient to allow of the escape of these gases they must remain trapped within the last portions of the metal to solidify and consequently will affect the internal soundness of the castings.

Rate of Cooling, Crystallisation, and Mechanical Strength.

The slower the rate of cooling the larger the crystals is a very well-known law connected with the crystal size and also the fact that the crystals grow at right-angles to the isothermal surfaces of the commencement of crystallisation. The observations of Brearley* clearly showed that according to the rate of cooling conditions two types of crystals, an elongated type and an equi-axed type, tend to form. The elongated type form under conditions of rapid cooling, and the equi-axed type under conditions of slow cooling. Under the conditions of slow cooling in sand moulds the tendency is towards the formation of equi-axed crystals.

The primary formed crystals in cast iron are largely broken up by the formation of graphite within them; but traces of the original crystallisation are invariably to be traced more or less marked under the microscope by following the direction of the dendritic structures revealed on etching.

In addition to the graphitisation, the rate of cooling controls the character and distribution of the crystalline structure across the section of the mass of solidifying cast iron, and on this account any consideration of the effect of the rate of cooling on the mechanical strength of cast iron must be concerned with at least these two features.

Experiments show that there is something in the nature of a critical dimension of any one type of bar of a given chemical composition having the maximum ultimate breaking strength. The experiments of Benney showed that the maximum strength values in the three different compositions of iron occur at certain dimensions of bar which is not necessarily the bar having the lowest graphitic carbon content. It must be carefully appreciated that these results only apply to conditions of normal cooling in sand moulds, and it is of interest to note that from these experiments the optimum silicon contents for various thicknesses of castings appear to be those abstracted below:—

Thickness, $\frac{5}{8}$ in.; silicon, 1.39 per cent.; $\frac{3}{4}$ in., 1.18 per cent.

This is exactly what would be expected from a consideration of the conjoint effect of the rate of cooling on both the graphitisation and the crystalline structure.

The Influence of Casting Temperature on Cast Iron.

Almost all foundrymen working both in ferrous and non-ferrous alloys have appreciated the fact that the initial casting temperature is of considerable importance, both from the point of view of the character of the final casting and also its mechanical and physical properties. The pioneer work of Longmuir with the object of determining the extent of the influence of this factor on the properties of both ferrous and non-ferrous cast

* J.I.S.I., No. 2, 1916.

alloys is now well known. As far as cast iron is concerned, the most important observations to be drawn from Longmuir's researches are that in every case a medium casting temperature gives the best results from the mechanical strength point of view. A remarkable observation was also made in the case of white irons that the influence of the casting temperature, whatever it may be, persists even after drastic annealing and heat treatment of the bars.*

The results of Longmuir's experiments on cast iron were not confirmed by Hatfield.† The important difference in the conclusions of this latter worker was that the highest casting temperature gave the highest mechanical properties. It should be noted, however, that those experiments were conducted on very thin bars, the cross-sectional dimensions of which were 1 in. by $\frac{3}{8}$ in.

The careful experiments of Hailstone‡ throw considerable light on the influence of casting temperature on the constitution and properties of cast iron, and these have not received the attention of foundrymen that they deserve. Hailstone's experiments were carried out on ordinary foundry metal containing a considerable quantity of phosphorus, and the mechanical strength values obtained on the series of tests confirm the experiments of Hatfield, the highest tensile strength being obtained with the highest casting temperature, the values decreasing gradually with the decreasing casting temperature

From the hardness figures as determined and expressed by the Shore method it would be concluded that the hardness of all the samples was about the same. Hailstone, however, carefully measured the diameter of the impression made by the rebounding hammer, and found that the diameter of the impression gradually increased with decreasing temperature, a fact which may legitimately be taken to indicate that the bars decrease in hardness with decreasing casting temperature. In a like manner the specific gravity was found to decrease with decreasing temperature, and in the bar cast at the lowest temperature the value was as low as 6.936.

Hailstone concludes from this investigation that "a cast iron of a given chemical composition has a certain range of casting temperature to produce a solid, dense and strong casting, which, in the case of the iron under investigation, is between the temperature of 1,428 deg. C. and 1,386 deg. C." Whilst Hailstone's experiments have not determined the maximum limit, if any, to the range of casting temperature, all the experimental evidence at present available proves definitely that for any given composition of casting there is a minimum limit of casting temperature to produce a solid, dense and strong casting. In the case of Hailstone's experiments this minimum limit is 1,386 deg. C., and the composition of the iron used in the experiments is approximately Cc, 0.40; Gr, 2.84; Tot. C, 3.24; Si, 1.87; Mn, 0.27; S, 0.09; and P, 1.41 per cent.

Mechanism of the Influence of Casting Temperature.

The actual influence of the casting temperature in bringing about this modification in the mechanical and physical properties has not been finally explained. The most striking influence of the casting temperature is its influence on the condition of the carbon. This was first pointed out by Dr. Hatfield, who found that in the grey bars of his series of test bars the high casting temperature actually assisted in maintaining the carbon in the combined state. Hatfield § has published further striking corroborative evidence in the shape of two bars, 2 in. × 1 in. × 12 in., of the following composition: C, 3.20; Si, 1.10; Mn, 0.41, S, 0.02, and P, 0.20 per cent.

The first bar cast with metal at 180 deg. C. higher temperature than the other had a mottled fracture, whilst the second one was perfectly grey. An examination of the specimens from the bars under the microscope showed the presence of primary cementite in the one cast at the higher temperature and graphite in the one cast at the lower temperature.

* J.I.S.I., 1903, No. 1; 1904, No. 1.
† J.I.S.I., 1906, No. 2.
‡ "Carnegie Scholarship Memoirs," 1916.
§ Proc. Royal Society, A., vol. lxxxv, 1911.

The retention of carbon in the combined state in bars of high-casting temperature is amply confirmed by the figures given by Hailstone, which are extracted in a convenient form in the following table:—

Table I.—*Showing the retention of Carbon in Combined State with Higher Casting Temperature.*

Sample No.	Casting temp.	CC.	Gr.	Total C.
2	1,400° C.	0.406	2.840	3.246
3	1,390° C.	0.399	2.862	3.261
4	1,386° C.	0.365	2.891	3.256
5	1,361° C.	0.366	2.915	3.281
6	1,348° C.	0.357	2.926	3.283
7	1,330° C.	0.340	2.951	3.291
8	1,302° C.	0.308	2.987	3.295
9	1,272° C.	0.293	3.012	3.305
10	1,264° C.	0.186	3.126	3.312

It would appear probable that the influence of the initial casting temperature is due to the influence exerted by this factor on the rate of cooling. The higher the casting temperature the quicker the rate of cooling under a given set of conditions, at least in the initial stages of the cooling. Quantitative evidence on this point is still wanting.

Desch, in the First Report of the Beilby Committee (*J. Inst. Metals*, No. 1, 1914) states "that it is perhaps legitimate to infer that undercooling will be more considerable the greater the difference of temperature at the time of pouring; but the two magnitudes are not necessarily in direct proportion to one another. It was found that the crystal grains became smaller (*i.e.*, the centres more numerous) the greater the rapidity of cooling, but at the lowest temperature examined the number of centres once more increased."

The variation in the mechanical test results was generally explained by Hatfield to be due to the variation in the condition of the carbon. With this conclusion the author is in perfect agreement, but in addition it will be seen from a brief inspection of Hatfield's own results that this cannot be the whole story. The variation in the condition of the carbon cannot account for the varying test figures obtained in white irons. The fact that Longmuir noted the variations attributable to casting temperature were maintained after heat-treatment, and which have occurred though not consistently in Hatfield's experiments, led Longmuir to suppose that some influence was exerted upon the structural characteristics of the iron. Whilst very definite microscopical evidence was lacking, Longmuir states that his microscopical examinations show that low temperatures favour a sharper crystallisation, and that the crystal junctions are very sharply defined and apparently form routes along which the fracture readily travels.

More definite evidence of the influence of casting temperature on the structural characteristics of cast iron has been found by Hailstone. This worker carefully measured the size of some of the micro-constituents, the graphite and the manganese sulphide, and showed the highest casting temperature members of the series contained the smallest and thinnest flakes and plates of graphite and the largest areas of manganese-sulphide. The distribution of the phosphide eutectic was found to vary from a well-defined network structure in the bar of the highest casting temperature to an irregular distribution in the case of the bar of the lowest casting temperature. Hailstone generally concludes that a cast iron poured at its proper casting temperature will always show a closer microstructure than otherwise, and the phosphide eutectic will be in network formation.

In this connection it is of importance to bear in mind the latter portion of the quotation from Desch given above. With a higher casting temperature and a consequently increased rate of cooling it would be expected that the grain size would be smaller, and this, in its turn, would explain the increased strength values obtained. In so far as the graphite and the manganese sulphur compound are concerned, this has been confirmed as above. Actual grain size measurements on cast iron are not, however, generally possible on account of the difficulty of revealing

the grain boundaries. Our experience with other alloys, such as gun-metal and brass, however, enable us legitimately to infer that the higher casting temperature within limits leads to a reduction in the grain size.

Casting Temperature and Dissolved Gases.

Some of the data throwing considerable light on the influence of dissolved gases in cast iron were also obtained by Hailstone. Hailstone investigated the amount of dissolved gases and their composition evolved on heating his specimens for 12 hours at 950 deg. C.

In the main Hailstone found that the bars cast at the highest temperature evolved the largest quantity of gases, and that the percentage of carbon dioxide, hydrogen and nitrogen in the gas evolved increased with decreasing temperature, the percentage of carbon monoxide decreasing with decreasing temperature.

The most significant fact in these experiments was that the soundest bars showed the highest mechanical properties, and contained the largest quantity of dissolved gases. Whether this fact is in any way responsible for the influence of casting temperature is by no means certain, but in the present state of our knowledge it would appear that the allegations as to the influence of small quantities of special elements with the object of improving the quality of cast iron by the removal of the dissolved gases is without experimental foundation. The correct procedure for ensuring soundness is to cast at a correct casting temperature.

Undercooling.

It has long been known that under certain conditions the temperature of solidification or the temperature of a transformation in the solid state may be passed in the cooling down of a crystallising liquid without the particular change taking place. In fact, the change may be delayed in many cases for 100 deg. or so below the normal change point, and under certain conditions certain changes may be entirely prevented. This phenomenon is known as undercooling or supercooling. The effect of undercooling is made apparent on the cooling curves by a depression of the arrest due to the particular change point for some degrees followed by a sudden rise. Immediately the actual change does take place it is accompanied by the liberation of heat raising the temperature to the normal, or approximately the normal, temperature of change point.

Undercooling of this nature very frequently occurs in metallic alloys, and an increase in the rate of cooling tends to increase the liability for this phenomenon to occur. Increased viscosity is likewise another factor which increases the tendency towards undercooling, and for this reason transformations in the solid state are liable to this phenomenon. If for any reason an alloy or liquid is retained in this undercooled state it is said to be maintained in a meta-stable condition.

Undercooling of this nature is advanced as the reason for the retention of the cementite-austenite structures in the iron-carbon alloys. It is considered in the dual conception of a stable and meta-stable system of equilibrium that the normal rates of cooling are sufficiently quick to maintain the meta-stable or undercooled condition cementite-austenite. The objections to this view have been dealt with previously, and it is a fact that the formation of graphite from the cementite takes place after solidification, and the cementite-austenite structures are the stable structures. Undercooling of the character above suggested would hardly be expected to occur, as it almost invariably does, in the presence of graphite—the stable phase.

Rate of Cooling and Diffusion.

In the crystallisation of alloys in which one of the constituents is soluble, in the other in the solid state, the composition of the solid-phase deposited during crystallisation is constantly changing. The extent of the change in binary alloys depends upon the initial composition of the binary alloy and the solubility of the one component in the other. The effect of this change in composition is made evident on examining etched structures of the alloys, the deposited solid solution crystals generally etching in such a manner that their central portions are lighter than their external portions. This characteristic etched structure is known as "coring," or a "cored structure," and is entirely due to the difference in composition of the respective layers of solid solution deposited during cooling.

Perfect equilibrium, in which this unevenness of composition is corrected, is largely a matter of the rate of cooling in allowing sufficient time for the uniform distribution of the composition by the process of diffusion. An example of a "cored" structure and the same structure in which the composition has been brought to a condition of equilibrium by diffusion is shown in Figs. 9 and 10.

This question becomes of increased importance in the case of the higher carbon members of the iron-carbon series of alloys where graphitisation of the deposited phases takes place on further cooling down. The distribution of carbon in the primarily deposited austenite crystals will depend upon the rate of cooling. In the case of quick cooling in the absence of any diffusion the outer layers of the solid solution crystals only will be saturated. In the event of diffusion taking place unless carbide is absorbed from the eutectic cementite deposited adjacent to the austenite crystals this primarily deposited austenite as a whole must be considerably under-saturated with respect to carbon, and the only saturated austenite present under such conditions must be the austenite in the eutectic itself.

It is a fact that graphite is never observed in the primary austenite crystals of nearly pure iron-carbon alloys cooled down under normal conditions, and very prolonged slow cooling or annealing is necessary to bring about the formation of the graphite in the primary austenite portion of the alloy. The graphite normally observed in the slow cooled irons of this type originates from the eutectic, but whether this primarily originates from the austenite or cementite portions of the eutectic has not yet been satisfactorily demonstrated.

In the ternary alloys containing silicon the conditions are somewhat further complicated, and ordinary commercial cast irons containing manganese, sulphur and phosphorus, the effect of the rate of cooling in bringing about local concentrations of the various components to such an extent as to influence the graphitisation phenomenon, can be readily imagined.

Moisture and Moulds.

By Plex.

When repairing a broken part of the mould it is advisable to do so without first moistening. Most moulders, however, apply water freely to the part about to be repaired, thinking that the moisture will make a better job. If the repaired portion is not drier than the mould as a whole, then water need not be applied at all. In all cases it is advisable to apply water sparingly. The amount of moisture applied to the upper half of the mould is not nearly so important as that applied to the lower half, because the escaping steam is able to find an easier outlet, not having to pass through molten metal; hence there is less possibility of defective castings.

A common fault is over, or uneven application of moisture when "finishing off." By adopting the following hint the moisture difficulty may be overcome. In place of the swab, or similar means of moistening the mould, use an ordinary gardener's spray, or one of the disinfectant sprays which are finding such a ready sale at the present time. These may be purchased for a few shillings at any ironmonger's or chemist's. The type that has a cylindrical reservoir near the nozzle is recommended. These emit a fairly dense cloud of water in vapour form. The advantage of this will be readily seen and appreciated. It will be found to be far superior to the swab method of moistening and more effective. Any intricate shape in the mould which appears to be crumbly may be effectively moistened without risk.

UM

60-K.V.A. Electric Resistance Furnace.

On the invitation of the Electric Furnace Company, Limited, 17, Victoria Street, London, S.W.1, and by the courtesy of the Birmingham Corporation, our representative was present at the Summer Lane Power Station, Birmingham, on September 10 to witness a demonstration of the furnace illustrated. It is scarcely necessary at this time to enter into details regarding the advantages of the electric furnace for many forms of heat treatment, as it is now generally recognised that by their use a material improvement in the quality of the product is assured with a substantial reduction in oxidation losses.

In the United States of America the resistance furnace has come into very general use for such varied duties as carburising, japanning vitreous enamelling, glass annealing, calorising, graphitising, as well as for the general heat treatment of metals. In this country the application of the electric resistance furnace for the above specified duties is in its infancy, not perhaps due to a lack of appreciation of its wide possibilities and advantages so much as to the cost of energy for its operation.

The furnace is built under the Wild-Barfield Patents, the Electric Furnace Company having made arrangements with Automatic and Electric Furnaces, Limited (owners of the patents referred to) to co-operate in the design of resistance furnaces above 25 k.v.a. capacity.

The shell of the furnace, as seen in our illustration, is built up of steel plates. The method of securing the door is simple and ingenious, wedge-shaped members on either side of the door engaging, when the door is lowered, with wedge-shaped brackets which are bolted to the furnace front, the result being a very effective joint between door and furnace opening. The heating element is nichrome wire arranged in spiral form in specially grooved bricks, connection being made across the phases at the rear of the furnace. The connections are protected by a sheet-metal casing and are all easily accessible. It will be understood that the heating elements are built up in unit form, an arrangement which readily lends itself to the varying requirements of heating furnaces; for example, in a carburising furnace no floor heat is permissible and ventilation to allow

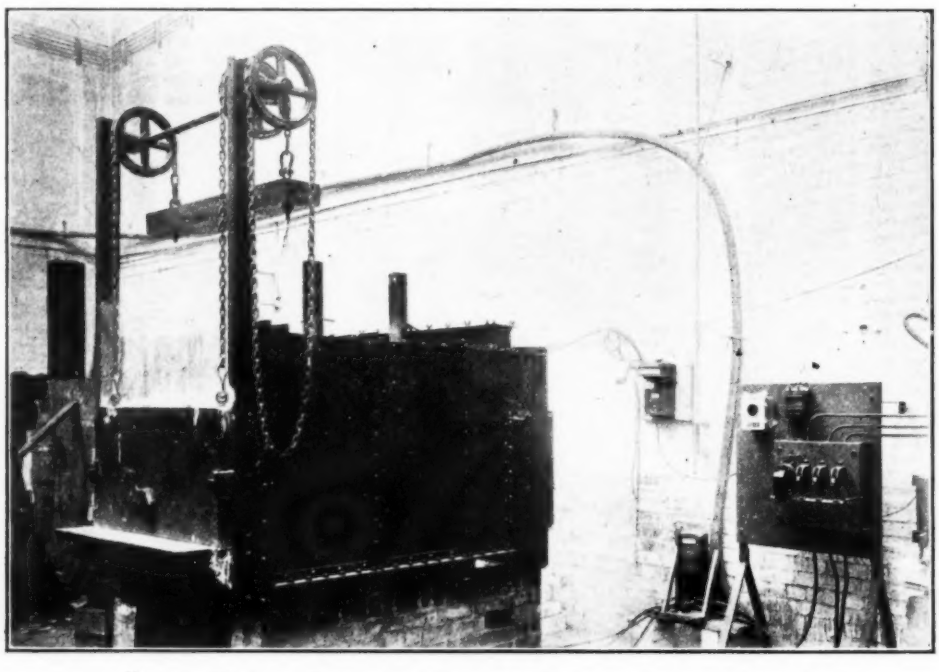

FIG. 1.—VIEW OF FURNACE, SHOWING ALSO INSTRUMENTS AND SWITCHGEAR.

Obviously, however, the cost of the heating media must not be considered independently; so many other factors contributing directly and indirectly to economy enter into the proposition, such as a better and a more uniform quality of output, the elimination of fuel and ash-handling and the additional cleanliness incidental thereto, and the practical elimination of highly-skilled labour as well as the substantial reduction in unskilled labour. The properly designed and properly equipped electric resistance furnace to all intents and purposes will take care of itself, not only in the matter of temperature control during its operation, but also in regard to starting up and shutting down; in a word, once it has been determined, a particular treatment for a given purpose can be repeated indefinitely and with positive accuracy simply by setting the clock.

The furnace under notice has a heating chamber 60 in. long × 40 in. wide × 20 in. high, and is, as already stated, of the resistance type of 60 k.v.a., in this case working on a 440-volt alternating-current circuit. Of course, one of the advantages of the resistance furnace is the possibility of its adaptation for operating on any ordinary low-tension supply whether direct current, single-, two- or three-phase alternating current; the use of a transformer is thus unnecessary. of the burning of hydrocarbons is essential. It will be understood that the heating elements in the furnace under notice extend for the full length of the sides and for the full length of the major portion of the roof. In the centre of the roof are arranged two chimneys, which are controlled by butterfly valves. When carburising, or annealing aluminium castings, or treating any parts more or less oily, the hydrocarbons are allowed to pass to atmosphere through the chimneys referred to. Ventilation may also be assisted by admitting air at the bottom of the back end of the furnace chamber through plug-controlled openings; either of these two openings could, of course, when desired, be used for an additional pyrometer.

The pyrometer is in the back centre of the chamber, and on either side of this are the silver-wire fuses. These fuses are designed to blow at about 950 deg. C. and thus protect the furnace from overheating. Red lamps at the rear of the furnace light up in the event of a fuse blowing. The auxiliary gear comprises a Cambridge temperature-control Venner time-switch and a main switch by the Igranic Electric Company. The method of operation is as follows:—The Venner switch is set to cut in at a given time and thus puts in the main switch and causes current to

pass to the heating elements. The temperature control with readings from 0 to 1,000 deg. C. is fitted with an auxiliary pointer which can be set at any pre-determined temperature, and when the working temperature of the furnaces reaches this point, current is cut off by means of a relay and electro-magnetic switch. With a fall of 1 per cent. of temperature within the furnace chamber the operations referred to are reversed and the circuit is once more closed. The time switch by which the furnace is started up can also be set to cut off the heating current at any pre-determined hour.

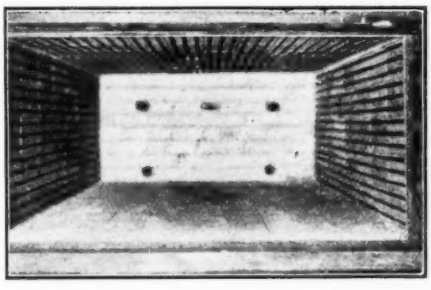

Fig. 2.—Interior of Furnace, showing Positions of Pyrometer, Silver-wire Fuses, and Auxiliary Holes.

Starting from cold it takes from 2½ to 2¾ hours to heat the furnace chamber up to a temperature of 900 deg. C. with a current consumption of 52 units per hour; once heated up current consumption is, of course, confined to making up radiation losses which in practice usually approximate to 20 units per hour. It is only in the broad lines of design that the electric furnace may be regarded as standard; the details must always be worked out to suit each particular industry. We have dealt with the carburising-process type of furnace, but it will be readily understood that the heating elements could be disposed in the floor of the furnace chamber, a form of heating which would be required for tempering hardened steel, essentially a low temperature operation and one requiring definite air circulation to secure uniform heating. For annealing brass, heating elements in the sides, roof and floor would no doubt be necessary. Indeed, there is scarcely a practical limit to the arrangement and disposition of the heating units.

Curing a Dusty Concrete Floor.

By "Vallishs."

Whilst it is true that many concrete workshop floors become very dusty, this inconvenience is by no means incurable. There are many ways and means of curing this common fault, but the writer only proposes to deal with one efficient method. The surface of the floor should first be examined to see that it is properly dry. Then mix together boiled linseed oil and gasoline, the last-named serving as a diluting agent. This mixture should then be applied to the floor, several coats being used. When the oil shows glossy on the top this is an indication that a sufficient amount of the mixture has been put on the floor. When dry the floor is then practically dust-proof. When linseed oil is well boiled it loses most of its volatile components, and this becomes practically permanent, whilst the gasoline thins the oil down to such an extent that it strikes into the pores. To give the correct proportions of the mixture is perhaps rather difficult, as some floors require a stronger mixture than another. Experimenting will soon determine the correct proportions required for any floor demanding treatment. It is very important to note that the thinner the mixture the more the coats that will be required, but the deeper it will strike in. In some cases seven or eight coats are necessary. The cost of this method is very low, and in most cases very successful, if patience and sufficient care is taken.

Corrosion and Alloy Steels.

By A. R.

Carbon steels are well known to be very susceptible to corrosion both in water and air, and particularly in a moist atmosphere polluted with much of the dioxides of carbon and sulphur. Tests have been made in many countries with different grades of steel under varying conditions, and the results appear to be fairly uniform in their general inference. It would seem that the greater the proportion of carbon in the steel the greater the susceptibility to corrosion. Also, the harder the metal the less it is attacked, so for high carbon steels to be used effectively they should be as hard as circumstances will permit.

The addition of chromium to steels does much to make them immune from corrosion. Comparatively large proportions of chromium are used, from 12 to 18 per cent., and the hardness of the alloy affects its corrodibility as with the carbon steels. The cast and hardened alloys are found to be much more resistant than forgings and alloys which have been annealed.

Chromium steels, especially those containing but little carbon, can be much improved in corrosion-resisting qualities by the addition of nickel, up to about 8 per cent. Such steels are resistant to a much wider range of corrosive agents. This makes them suitable for many purposes in chemical engineering.

Corrosion experiments with steels containing a small percentage of copper—carried out in this country by Sir Robert Hadfield and in Germany by Professor O. Bauer—appear to show that about 0.2 per cent. of copper has a protective effect on steel. The results are regarded with some doubt in many quarters, but the experimenters themselves are quite definite in their statements of results.

In factory air containing an abnormal proportion of carbon dioxide and sulphur dioxide the "copper-steels," as these alloys have been named, are found to be more resistant to corrosion than ordinary steels. These results are found to be similar, whether the steel is coated with scale or exposed to a clean machined surface.

Experiments have also been tried with these steels immersed in sea-water, fresh-water, and sulphuric acid. Salt-water corrodes ordinary steel, if unprotected, very quickly. After a time a protective coating of oxide is formed and corrosion is retarded. With copper-steel the initial corrosion is not so quick, but the ultimate result is similar, a protective coating being formed.

With fresh water the results are similar to begin with, but the corrosion is more persistent, as no protective coating is formed, and there is not a very great difference in the resistance of the pure and the alloy steels. With sulphuric acid the metals would appear to be similar in action to begin with, but the copper-steel becomes partly resistant sooner than the other. This may be due to the formation of a coating with superior resisting qualities.

Centrifugal Casting Development

The firm of Messrs. R. D. Wood & Company, of 400, Chestnut Street, Philadelphia, Pa., is installing plant for the manufacture of centrifugal pipe, but using rotary sand moulds. The capacity is to be 400 tons per day.

Dr. Richard Moldenke has been awarded the first Joseph S. Seaman Gold Medal for his many contributions to the foundry industry. The award of this medal is in the hands of the American Foundrymen's Association. Another honour which this association is in a position to bestow is the MacFadden medal, and it has chosen Dr. Robert J. Anderson as the recipient. The doctor has an international reputation as an expert on aluminium and its alloys.

XUM

The Selling of Castings.—XIX.

By Voyageur.

House Organs.

One of the most effective means of securing orders for castings is the circulation and compilation of an efficient house-organ. It must be borne in mind in this connection that by house-organs is meant not a journal for internal circulation among employees, containing works and staff news, short stories, cartoons, etc., but a carefully edited and well-written journal, the purpose of which is to give to customers and potential users of the manufacturer's products valuable information concerning the goods, the business, and so forth. Such a journal, though it appears at regular intervals and contains articles of an interesting character, is not in any way designed to compete with existing professional journals, but is intended simply to give particularised news of a particular class of products that the professional journal can only discuss occasionally or in a general fashion. But the editorial standards of a good house-organ must approach the standard of a recognised professional journal, or the result will be a dismal failure. Far too many house-organs contain funny stories, or articles that are merely thinly-veiled puffs of the manufacturer's own goods. This is useless. The keynote of the house-organ must be "service." But before one goes on to outline in detail the subjects with which the articles should deal, it will be as well to recount briefly the advantages of a house-organ as a means of increasing foundry business. For this purpose it must be assumed that the journal is efficient. The prime advantage, then, is the fact that it is useful to customers, and therefore highly appreciated by them. It tells them how to save money on the castings the manufacturer makes, either by exercising more care in their design or by observing certain rules that will lessen buying prices.

Secondly, it has all the good qualities of a circular without its defects. It does not need to urge the placing of orders; it does not need to waste time in preliminary argument; and what is more, it is likely to be kept and filed for the valuable information it contains, which seldom happens to the ordinary circular. Thirdly, by its regular appearance it ensures that the manufacturer's name is brought periodically before the customer's notice. It has a businesslike appearance, and the very fact of its publication and distribution is a proof of the importance and prestige of the firm that issues it. It gives news about the business, and facts about new manufactures taken up, in a speedy and at the same time effective way.

But all these advantages are nullified at the outset if the policy behind it is wrong. There is a strong and ever-present temptation for the manufacturer to use the opportunity of expressing himself in print as a means of lustily blowing his own trumpet. This is fatal. A busy man will not sit and read page upon page of self-praise. He is only to be tempted by practical, interesting, well-compiled and well-written articles on subjects of direct importance to himself. For this reason the editorial tone of the journal must be free from any suggestion of partiality. The articles must be of such a character that they would not be out of place in a reputable trade-journal. Whenever it is necessary to mention the manufacturer's goods by name, this mention should be as free from descriptive adjectives as possible. Thus: "The John Smith aluminium castings," and not "the world-famous super-quality John Smith aluminium castings." In brief, every article—apart from "news" items such as those outlined in a later paragraph—should be so written that it is valuable whether the reader uses these particular castings or some of a different make. In this way, his confidence in the good faith and impartiality of the articles will be won, and he will gradually attach a greater weight to the journal's suggestions. Anything the manufacturer wishes to say directly about his own goods he should confine to the advertisement columns of the journal. Here he can talk about them without any pretence of impartiality. But in the text of the articles he must preserve strictly impersonal wording.

It must be remarked that the manufacturer of one special type of casting only will find it less easy to sustain the interest of his articles than the maker of a complete range of castings; but this need not deter him from inaugurating a house-journal. There are many magazines of this kind that have been carried on with complete success and with great variety of matter for many years by makers of one product only.

General Scope.

For convenience, the class of matter contained by the journal will be divided into two categories: special articles and regular features. Regular features can be discussed first.

1. *Direct Advertisements.*—The writer believes these ought to be confined to those of the manufacturer alone, since the journal is essentially the organ of his business and no other.

2. *Problems Investigated.*—In columns set aside for the purpose, the manufacturer should give details of any casting problem or problems of an interesting character that he has solved for customers during the past month or so, between one issue and the next, and an account of how he solved it. This often attracts the eye of a buyer with a similar problem, and leads to more business.

3. *American and Continental Notes.*—Under this heading there should appear summarised articles or extracts taken from the foreign and Continental Press. These summaries should, of course, be of articles on subjects connected with the castings in which the manufacturer and his readers are interested. In other words, if the manufacturer's house-organ deals with grey-iron castings, it is his business to keep his readers acquainted with all the news of the grey-iron world that is likely to interest them. He should remember, however, that it is the interest of the user that should govern his selection of extracts rather than his own. Thus, he himself may be interested in a new manufacturing process, an account of which would not interest the user in the slightest degree.

4. *Letters to the Editor and Answers to Correspondents.*

5. *A Note of Forthcoming Articles.*

6. *Details of Contracts Placed or Big Orders Received.*

Type of Articles to be Used.

Turning now to special articles, a brief list of good subjects is appended, with a few explanatory notes to indicate their scope.

1. *How to Buy the Castings.*—Hints on selecting the right type of casting for a particular class of work. Things to be borne in mind when comparing quotations. Where money can be saved. When to buy in bulk, or singly. Contraction allowances for patterns. Castings finished-machined, or in the rough.

2. *How to Order the Castings.*—Details required by the manufacturer, and why. Mistakes to be avoided. Value of sketches. Value of consultation with the founder before fixing design.

3. *How Castings are Made.*—Notes on foundry processes, specially indicating any feature that makes for a better casting.

4. *What the Castings are Made From.*—Raw materials and sources of supply. Component parts and reputation of their makers. Why one source of supply rather than another.

5. *How the Castings are Tested.*—Mechanical processes and machines described. Importance of tests.

6. *How the Castings are Packed, when Necessary.*—Importance of good packing. Precautions taken to avoid damage. Method of handling in transit (*a*) inland, (*b*) overseas.

7. *Who Uses the Castings.*—Details of famous or well-known firms' use of the castings. Details of any novel or striking applications made by them. Unsolicited users' reports, or reports of satisfactory trials.

8. *What Castings are Used For.*—Notes on the different uses to which the castings are put, or on new uses, or on possible uses.

9. *The History of the Castings.*—Notes on the early history of the castings; on the inventors, the originators, or the discoverers of the foundry processes by which they are made; on the early history of the firm; and so forth.

10. *The Literature about Castings.*—Notes on any new catalogue, giving an outline of its con-

tents, and exciting in the reader's mind a desire to possess and retain it. (Exaggeration or misleading statements must, however, be carefully avoided.)

11. *New Products.*—Notes on new products, new devices, new lines, of castings, new commodities, introduced. These notes should confine themselves to facts and a relation of new features, and not lapse into mere eulogy.

12. *The Men behind the Castings.*—Articles, brief but informative, on the managers of the various producing departments, bringing out their experience, qualifications, and so forth.

Although the above does not by any means exhaust the list of potential subjects for discussion in the pages of a foundry house-organ, it serves to indicate the lines to be adopted, and will afford a jumping-off point for the beginner. All the articles suggested above deal directly with the castings; but in practice it will often be found a good plan to insert articles occasionally that deal with less immediately relative matters. Thus, if the product were gear-wheel castings there would be nothing wrong and a great deal right in inserting an article on the grinding of the teeth of gears.

Notes on Receiving Castings.

By W. J. H.

As in many factories the arrival of a consignment of castings leads to a period of excitement and confusion before the castings are delivered into stock, the following notes may be of use to those firms whose receiving department apparently fails to deal with the matter with promptitude and despatch.

In the first place, the receiving clerk should be given a copy of every order covering the purchase of castings, this giving the name and address of the foundry, together with the quantity and the pattern number of the castings ordered. The price may be omitted by cutting down the carbon paper so that it does not cover the price column of this copy when the purchasing order is being made out.

The buyer should insist upon the foundry furnishing an advice note whenever a consignment is despatched, this either accompanying the castings, or being sent through the post. If the latter procedure is favoured, the advice note should be sent so that it arrives before the castings.

The advice note should give detailed particulars of the castings despatched, and not, as did one which recently came to the writer's attention, merely state "480 iron castings," when the consignment in question covered no fewer than 16 different types of castings. The number of castings to each pattern number should be stated, together with the weight, and also the order number against which the castings have been despatched.

It is essential that the records of the foundry and those of the buyer agree, otherwise there is trouble when the invoice appears, and also when the buyer is speeding up further supplies. The latter does not like to be informed that the order he quotes has been completed, but that supplies will be sent against another order. There may be two or more orders placed for the same type of casting, but the buyer invariably makes a point of clearing the oldest order first. If the foundry shows a tendency to skip from one order to another, when making deliveries, the receiving clerk should draw the buyer's attention to this, and the latter will instruct the foundry to complete one order before booking against the second.

Castings may be received *via* road, rail or canal, and they may arrive loose, in sacks, or packed in cases or casks. The advice note should state the mode of transit, also whether packed or loose. If loose, the aggregate number of castings should be stated apart from the detailed quantities, as this facilitates counting when unloading. If packed in cases or casks, the number of such cases or casks should be stated, and if consigned in sacks, the number of sacks should be given. If the packages are returnable, this fact should appear upon the advice note, and the receiving clerk will then see that the unpacking is done in such a way as to ensure the least possible damage being done to the package.

The mode of transit is of interest to the receiving clerk, for if the advice note is received in advance he can form a fairly accurate idea as to when the castings will arrive, and can make arrangements accordingly. This, of course, applies to consignments coming from a distance, as opposed to castings purchased locally.

The mode of transit is of interest in another sense, namely, the question of breakages. Assuming ordinary care to have been taken by the foundry in regard to despatch, the consignments sent by road have the fewest breakages, if the journey has been continuous, and there has been no transhipment. In the matter of castings sent by water, these are almost immune from breakage, but this immunity is disturbed by reloading from the barge for conveyance to the customer's works. The heaviest proportion of breakages occur in the castings consigned by rail.

Immediately upon arrival, and while the castings are being unloaded, all loose parts, and also packages, should be counted. Loose castings should be superficially examined for breakages, and packages for any sign of damage. Any damage or breakage should be recorded upon the carman's consignment note, and even if everything is apparently quite in order, the receiving clerk should qualify receipt by adding the words "Not examined."

It is, of course, impossible to open packages and check the contents whilst the carman waits, but this must be done at the earliest possible moment. When the castings are unpacked, they are checked for quantity against the advice note, and then checked for weight. In some works the latter formality is dispensed with, the weight given upon the advice note being regarded as authentic, but this is a mistake.

After this has been done, a goods received note should be made out, this being in accordance with what has actually been received, and not what *should* have been received. Some firms adopt the latter course, so that the inspector can see the difference (if any) between the goods ordered and those actually received, but the course is not to be commended, as obviously in such circumstances the note is not functioning properly, seeing that it does not (when there is any difference) give a true indication of what has been received. The better method is for the goods received note to show what has been received, and for this to be attached to the purchasing order and handed to the inspector, who will then be able to see what differences exist between the terms of the order and the goods received.

Every casting received should be separately examined by a competent inspector, one who is alike familiar with the casting and its purpose. If the castings are purchased from a reputable foundry, the examination of even a large batch should not be a lengthy process. The inspector definitely rejects castings for blowholes which are visible, also warped castings and those which do not conform to the specification, both in regard to finish and also to displacements or omissions (such as boss in wrong position or omitted, etc.). He also comments upon the quality of the castings, if this is below the standard, even though he does not definitely reject them, and these comments are noted by the buyer when placing orders for further supplies.

When inspection is completed the castings are passed to the storekeeper and placed in stock.

Commercial Alloy Steel in the United States.—The United States Steel Corporation will shortly proceed to establish in the Chicago district a large plant for the production of commercial alloy steel, including a large bar mill at South Chicago.

Czecho-Slovak Iron and Steel Industry.—A convention has been arranged between the iron and steel-makers of Czecho-Slovakia and German Upper Silesia, securing for the former at least 25 per cent. of the latter's surplus output. The Cartel of the Czecho-Slovak and Austrian makers (to which the Hungarian Rimamurány concern also belongs) are in negotiation with the makers in Polish Upper Silesia with a view of inducing the latter to join the Cartel. Representatives of the Czecho-Slovak iron and steel industry are to go shortly to Essen, where the conference between French and German iron and steel makers is to be resumed, and where representatives of the industry from Hungary, Rumania and Yugoslavia are also to be present.

XUM

New Direct Process for the Manufacture of Steel.*

By Henning Flodin (Stockholm).

This Paper describes a series of experiments in the direct smelting of ore by electric means, carried out at the Electro-Chemical Section of the Royal Technical High School at Stockholm during the years 1923-25. It may be mentioned that the Electro-Chemical Section of the above-mentioned establishment, the principal of which is Professor Wilhelm Palmér, is equipped with a special electro-metallurgical laboratory, open at a nominal cost to qualified inventors, so that they may elaborate their ideas to the benefit of the industry by carrying out experiments on a sufficiently large scale to be of practical and scientific value.

The object of these trials was to ascertain whether malleable iron and steel can be extracted direct and continuously from iron ore, and at the same time to reduce the percentage of phosphorus and sulphur content in the ore and coal. An electric furnace was specially constructed for the purpose, working with a load of about 30 kw.

A few trials alone sufficed to establish that iron with carbon from 0.02 per cent. and upwards could be produced without difficulty. In order to prove that this was not merely a chance result from a small number of smeltings, sixty-five such trial reductions were made in a furnace of the particular construction mentioned, the results of which fully bore out that the method pursued was on the right lines. The effects were so encouraging that, on the initiative of Mr. G. Cornelius and Mr. A. Hammarberg of Stockholm, it was decided to test the process thoroughly on a reasonably large industrial scale at the ironworks at Hagfors, Sweden. An electric furnace with a load of 250 to 300 kw. was used, and up to the time of writing 114 tappings have been made. Analyses made at the chemical laboratory at Hagfors show the composition of the product to be:—Carbon, from 0.02 to 1.32 per cent.; phosphorus, 0.003 to 0.017 per cent.; sulphur, 0.009 to 0.077 per cent.

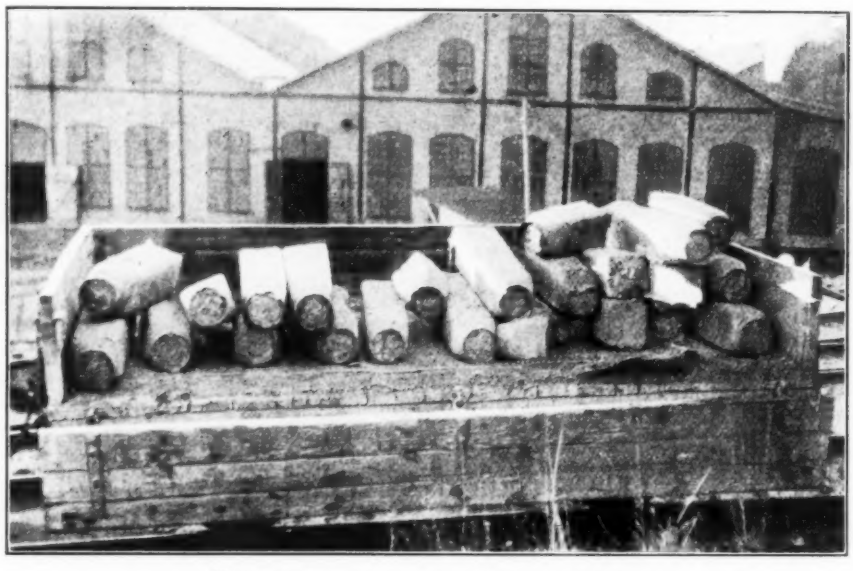

FIG. 1.—INGOTS MADE AT HAGFORS, SWEDEN.

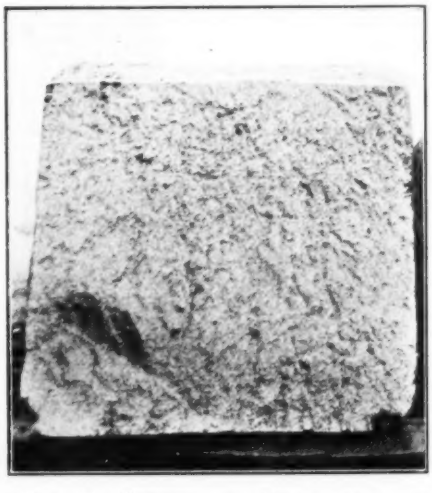

FIG. 2.—SECTION OF INGOT MADE AT HAGFORS.

Results of tests carried out by Mr. O. Caspersson, engineer, shown in Table I, indicate the physical and mechanical properties of the iron and steel produced:—

TABLE I.—*Tensile Tests.*

No. of tapping.	Yield point. Kg./mm.²	Tensile breaking strength. Kg./mm²	Elongation* per cent.	Reduction of area per cent.	Condition of test-piece.
19	24.3	32.4	34.0	59	As rolled.
26	22.2	32.5	30.0	64	Turned from 25-mm. square, rolled bar.
27	25.4	35.3	28.5	65	Turned from 28-mm. square, rolled bar.
41	—	40.8	29.5	63	Turned from 12-mm. round, rolled bar.
42	—	45.8	12.0	61	Wire, as rolled.
42–1	—	37.7	29.0	73	Wire, as rolled and annealed.
56	31.8	45.8	25.0	54	Turned from 28-mm. square, rolled bar.
16	36.2	47.2	24.7	43	As rolled.
60	45.8	89.8	8.5	15	Turned from 28-mm. square, rolled bar.

* The elongation is measured on a gauge length of ten times the diameter of the test-piece.

It may here be observed that, during one of the furnace runs at Hagfors, the author was requested to vary the proportion of carbon in several successive tappings:—

Required.	*Results.*
(1) 0.40 per cent. carbon	0.42 per cent. carbon.
(2) 0.20 ,, ,,	0.23 ,, ,,
(3) 0.80 ,, ,,	0.78 ,, ,,

Thus it was found that there was no difficulty whatever in producing iron and steel of any

* A Paper read before the Iron and Steel Institute.

desired carbon percentage at successive tappings without interruption of the process, showing that the process can be controlled in the same manner and quite as easily as the discontinuous open-hearth process. The manganese and silicon contents are controlled in the same manner as in the open-hearth process. From the heat No. 3 containing 0.78 per cent. carbon, an ingot was taken and rolled out at the Forsbacka Ironworks, Sweden, and the material was used for making chisels for pneumatic hammers, drills, and miners' sledges, mainly for the purpose of testing the material. The chisels have proved to be fully equal to those made of the firm's own Bessemer steel, and nearly as good as those made of special steel alloy for the cutting out of blanks of hard steel and chrome steel (1.40 per cent. chromium, 1.10 per cent. carbon). The drill penetrated 0.4 metre into granite in a wet borehole without regrinding, and 0.6 metre into hard sandstone bored dry. Better results cannot be obtained with the best Bessemer steel. The sledges were even superior to those made of 1A Bessemer steel.

The total radiation surface of the experimental furnace at Hagfors was 30 sq. metres, and when running empty the furnace took about 100 kw. At a load of 300 kw. the furnace was therefore working with 200 effective kw. A 3,000-kw. furnace has a radiation surface 2.5 times larger than the experimental furnace, or 70 sq. metres, so that the heat loss would be $2.33 \times 100 = 233$ kw. In this furnace the effective load is therefore $3{,}000 - 233 = 2{,}767$ kw. The losses due to water-cooling in the moulds, in contact rings and refrigeration, etc., amount to 263 kw., making the total loss 500 kw.

The loss of power at a load of 300 kw. in the experimental furnace was 33.3 per cent. In the 3,000-kw. furnace it was 16.65 per cent. The loss on transformers and lines is not included, as the measurements were taken close to the furnace. For this moderate expenditure of energy the price is not so important a factor as one would be induced to expect at the first glance.

At a load of 300 kw. 1 ton of iron was produced in the experimental furnace, with an expenditure of 2,700 kw.-hrs. Deducting 100 kw.-hrs. for empty running, the production thus amounted to 111 kg. per hour.

The 3,000-kw. furnace is to work with a net amount of 2,500 kw. (3,000 less 500 kw. loss). The production will therefore be :—

$$\frac{2500 \text{ kw.-hrs.} \times 111 \text{ kg. per hour}}{200 \text{ kw.-hrs}} = 1388 \text{ kg. per hour.}$$

The gross expenditure of energy in the furnace will thus be :—

$$\frac{3000}{1.388} = 2162 \text{ kw.-hrs. per metric ton of iron}$$

The heat content of the waste gases amounts to between 2,700 and 2,900 calories.

If in Scandinavia the cost of hydro-electric energy is put at 50 to 60 crowns (55 to 66 shillings) per kilowatt-year, it is evidently cheaper than steam-power. According to American statistics, the price of water-power is 15 to 25 dollars per kilowatt-year, and the cost of power from large steam-power stations is 20 to 25 dollars per year. These prices, of course, only hold good for a constant load by day and night. With regard to future power stations installed at a great cost to take a maximum load for some few hours per day only, the conditions are, of course, different.

With respect to the method itself, it is unnecessary to point out that in this direct process the previous production of pig-iron is dispensed with. The process works direct on a mixture of ore and coal in a single furnace, and the product is in the form of malleable iron and steel capable of being teemed into chills or other moulds in the usual manner. The process, however, does not only work direct as "one single process," but is continuous, interruptions occurring only at the moments of tapping, when the continuous feeding in of the mixture of ore and coal ceases, to recommence immediately after the tapping is complete. The operations must of course be carried out in such a manner that the furnace is fed with the mixture of coal and ore in quantities corresponding to the capacity of the amount of electric energy supplied for reduction and fusion.

The reduction of the iron proceeds uninterruptedly and continuously. The metallic iron particles reduced from the ore may be likened to a fine rain continually dropping through the slag bath to the bottom of the furnace, where the molten malleable iron constantly accumulates. Practically speaking, the iron is in a fit condition at any moment for tapping in varying quantities in proportion to the rate of reduction, and it is hardly to be imagined that a higher degree of continuity can be secured in any process for the production of iron.

The raw materials used at Hagfors in the experimental furnace are Swedish hematite ore, and both English coal and Swedish charcoal. No refinement in special furnaces is necessary for the removal of phosphorus and sulphur to a sufficiently low point, the process being based on the principle that in the reaction the molecules are in contact, thus facilitating the transfer of the phosphorus and sulphur to the slag. A specially low-carbon material produced by the "one single process" may perhaps meet certain requirements for electric and magnetic purposes, and the product is generally suitable for any purpose where an extremely low percentage of carbon in the iron is desired. After the thorough tests to which both the iron and steel materials produced at Hagfors have been subjected, the author is satisfied that their quality is superior both to the open-hearth and the Bessemer products. While it is true that no scientific investigations have been made into the causes which make such results possible, we are justified in assuming that the superiority of the product of this electric process is due to the relative absence of gases and the small amount of slag. The process works constantly under exclusion of air, and with a slight over-pressure in the furnace. Attention is specially directed to the low percentage of carbon (0.02), and it may confidently be expected that cheap stainless iron and steel produced by the "one single process" will soon appear on the market.

Protective Coatings for Steel.

By A. R.

A commercial method of protecting iron and steel is by a coating of some other metal. Many coverings have been tried, among them zinc, lead, tin and aluminium. It has been found by experiment, and these results have been supported by practice, that for a coating to be successful it must be electro-positive to the iron or steel, that is, in the presence of an electrolyte the iron or steel is not eaten away. If the coating is electro-negative —lead, tin, copper, or nickel, for instance—the presence of an electrolyte greatly augments any corrosive influence. Because of this and also because it is relatively cheap, a zinc coating is the most used commercially.

There are four principal methods of zincing. The simplest is by dipping the articles to be treated first in a solution of ammonium chloride, which acts as a flux, and then into molten zinc, a fairly uniform covering being thus obtained. Another method, "Sheradising," consists in heating the articles in zinc dust in a closed oven for several hours. This process has the advantage over dipping that an alloy is formed on the surface of the steel, whereas in dipping the covering may often be peeled off if it becomes loose in one place. Also an alloyed surface takes paint better than one dipped.

Covering with zinc may also be effected by an electro-plating process. The steel articles are placed in a solution of zinc sulphate, and are made the negative pole of a circuit in which a slab of zinc is the positive pole. On passing a current zinc is deposited on the steel, but care has to be taken that the covering grows evenly, as projections are liable to collect most and hollows least.

Zinc and aluminium have also been sprayed on to finished articles and structures by means of a special "pistol." The process is similar in many ways to paint spraying, but instead of using compressed air for projection an inert gas or a reducing gas is used.

XUM

Complimentary Dinner to Mr. A. Moore.

Prominent South African Foundryman entertained.

Last Thursday, at the Engineers' Club, Coventry Street, London, W.1, there was a very happy little gathering of foundrymen and others connected with the foundry industry to do honour to Mr. Arthur Moore, who is a proprietor (with Mr. F. Hobbs) of the Standard Brass Company, of Benoni, South Africa. The purpose of the gathering was to entertain Mr. Moore to dinner, and to present to him a memento of his visit to this country. The function was organised by Mr. V. C. Faulkner, vice-president of the Institute of British Foundrymen, who said that, in addition to entertaining Mr. Moore, who was returning to Africa on the following morning, a purpose of the function was to cement the relationship and good-fellowship existing between Great Britain and the Dominions.

Those present included (in addition to Mr. Faulkner—who presided—and Mr. Moore) Mr. Wesley Lambert, Mr. Cook (one of the founders, and a Past-President of the Institute of British Foundrymen), Mr. H. G. Sommerfield, Mr. R. J. Shaw, Mr. F. J. Wares, Mr. F. J. Barraball, Mr. H. O. Slater, Mr. A. L. Wells, Mr. G. Hall, Mr. Henry S. Clark, Mr. Sydney V. Toy, Mr. I. C. Rapp, Mr. W. O'Keefe, and Mr. W. F. Sklenar.

Imperial Co-operation.

The loyal toast having been honoured,

MR. FAULKNER addressed the gathering. In the first place he expressed regret that they had been unable to entertain Mr. Moore earlier. Mr. Moore had been in the country for about three months, and when those present knew something of his attributes, they would realise that in common with so many others from the Dominions, he was difficult to find when he was wanted. They were all very glad, however, to have the opportunity of doing honour to him. Apart from the personal aspect, however, there was another to be considered. It was a very desirable thing that we in this country should make contact with our Dominions whenever and wherever possible, and during the last few days he had received a very good instance of that. This was a letter, recently published in an American contemporary, from Mr. Arthur T. Alexander (Manager of the Australian Malleable Iron Company, Limited, of Port Adelaide, South Australia), which read:—

"My one and great regret is the fact that none of your advertisers, with the exception of one, has any agencies or stocks in this vast country. I read of your wonderful core oils, moulding machines, sand mixers, vibrators, etc., together with the hundred and one little accessories which go to make foundry life a little easier, but when I realise that I have to buy money orders, arrange shipping, and all the rest of it, and then take the chance that I will get what I expect, always from somewhat meagre information given in the advertisement, it is not worth the worry.

"No one in Australia stocks any foundry equipment—all we can buy here is blacking, coal dust, brick dust and core gum. That is the lot. So you see what one has to put up with. Now there is a virgin idea for you to work upon. It is no use having agents and no stock—samples and no bulk, or a heap of literature and no prices. The ——— people have an agent here, but no prices, and the agent does not know a stripping plate machine from a bottom pour ladle. So go ahead and see if you can do anything. Australia could easily support a firm like ———, and do big business.

"Another thing—when one writes for a quotation or further particulars, in a great many cases the advertiser only answers half the questions, is unable to quote, for some foolish reason, cannot quote f.o.b. steamer, etc., until you get disgusted and finally design and make the machine yourself, not feeling inclined to wait another three months for a fresh reply.

"You can only write and get a reply to four letters a year from Australia.

"If at any time you want information about Australia, just ask, and I shall be pleased to do anything I can for you."

That letter, said Mr. Faulkner, showed the importance of a closer co-operation between the Mother Country and the Dominions, in order that we may realise the requirements of the Dominions' foundry industry, and what steps are necessary to take to meet them. He asked Mr. Moore if he had found a similar state of affairs in South Africa; if he could give advice to equipment manufacturers here as to what is wanted there, and how to do business, it would be welcomed, for the good of the relationship between the Dominions and the home country. He felt that the British stood alone, so far as Europe was concerned, in looking after their visitors. The Continental countries did not make visitors so comfortable, but the Americans did not make that mistake, and that was why they were such real competitors to the British. The guest that evening had many excellent attributes. He had a charming disposition, and was certainly a great sportsman. As a foundryman he was British trained; he was apprenticed to a foundry in South Wales, and afterwards worked in the great foundry centre of Birmingham. Another attribute was that he was a politician; he (Mr. Faulkner) had understood that Mr. Moore was to be Mayor of Benoni, but he had suggested that his business responsibilities would not allow him to shoulder the civic duties. His firm, the Standard Brass Company, of Benoni, catered primarily for the requirements of the Rand, the mines of which were situated in the neighbourhood of Johannesburg and Benoni.

Technical Co-operation.

Although Mr. Moore was leaving England on the following morning, they wanted him to follow the lead of his partner, Mr. Hobbs, and to become a member of the Institute of British Foundrymen; they wanted him especially to associate himself with the London Branch, which, in the normal manner, looked after its Dominion and foreign members. Also, they wanted him to take a message from the home country to the foundrymen in South Africa, to ask them to see what they could do to form a branch of this Institute there. The Colliery Managers' Association had formed a Branch in India, and the scheme was working excellently. The members of that branch had the benefit of the whole of the work done in England, and they had their own supplement, which was bound with the Proceedings. There was no reason, except, perhaps, the great distances to be travelled, why there should not be a Branch of the Institute in South Africa. There need be perhaps only one meeting annually, at which the members could discuss business at a meeting under separate auspices as well as purely technical problems, whilst Papers for discussion could be sent from England if thought desirable. He had had a letter from the Mitchell Foundry, in Canada, which stated definitely that foundry technical literature emanating from Great Britain contained the best of any material which ever circulated in Canada. He did not know exactly whether Canada was more advanced technologically than South Africa, but he imagined it was, owing to its proximity to the United States: in fact, a large amount of excellent quantity production work was carried out there.

He asked Mr. Moore to take back to his colleagues in South Africa the best wishes of the whole of the foundry people in Great Britain. He had received a number of apologies from gentlemen connected with the British foundry industry for their inability to attend the gathering, but they all wished to be associated in any movement which helped to cement any friendships which could be established between the home country and the Dominions.

South Africa's Potentialities.

MR. WESLEY LAMBERT (Past-President of the London Branch of the Institute), who recently returned from a visit to South Africa, supported

Mr. Faulkner's remarks. He had had the pleasure, he said, and it had been a very great pleasure, not only to meet Mr. Moore in South Africa, but to become associated with him as a colleague, to travel home with him, and to spend many happy hours in this country with him. The primary purpose of the gathering that evening was not only to show the good-fellowship of those connected with the London foundry industry towards Mr. Moore, but had a broader purpose, namely, to show the feeling that prevailed, that they, as representing the industry, should become much more intimately associated with the foundries throughout the British Empire. There was a number of very well-equipped foundries in South Africa. He had had the privilege of visiting nearly all the railway works and a very large number of the mines, and those who had not visited South Africa could hardly realise the immense amount of capital involved in mining alone. The larger mines had plant representing something like three million pounds sterling, and that plant had to be provided before they could delve anything profitably from the earth. Well-equipped power stations, hauling plant, stamps, mills, etc., were to be found, and the upkeep of both the mining and railway plant necessitated the establishment of local foundries. Nearly all the large mines had very extensive workshops, and in a number of cases foundries also, and it behoved the Institute of British Foundrymen, as the parent body of foundrymen in this country, to become more intimately associated with those foundries. Mr. Moore had not visited London for something like 22 years, and when he returned to South Africa he would be in a position to say that there had been a very considerable amount of progress made in the homeland foundry industry. He (Mr. Lambert) was very pleased to be present that evening, because they were reciprocating, though to a very limited extent, the hospitality which was extended to him by Mr. Moore and his colleagues in South Africa. It was a very difficult matter indeed, when a South African visited England, to reciprocate in anything like an adequate manner the hospitality which was extended to an individual from this country when visiting in South Africa. Wherever he went in South Africa he had received a most cordial reception, but, as Mr. Faulkner had said, when gentlemen from the Dominions visited this country they were elusive. He supported Mr. Falkner in wishing Mr. Moore every success, long life and prosperity in South Africa.

American and Dominion Visitors' Methods Contrasted.

MR. F. J. COOK (one of the founders, and a Past-President, of the Institute of British Foundrymen) said that he had had much to do with entertaining Americans and being entertained by them; also, he had visited America to give the first exchange Paper between the American Foundrymen's Association and the Institute of British Foundrymen, and certainly had had the time of his life there. But what had struck him in connection with entertaining overseas visitors was that, whilst we in this country always seemed to know when the Americans were coming, and had an opportunity of entertaining them, we never seemed to be able to get into touch with our Colonial friends. He personally was quite sure, and he believed he could speak for everybody in the foundry trade in this respect, that we had a greater desire to entertain our Dominion friends even than we had to entertain Americans. He did not know any man who had carried away from this country a better and greater conception of what we in this country are than did the late Mr. Backert. When Mr. Backert had visited this country from America he had been impressed with the dignity which appertained to everything here, and with regard to what we were able to do, and he went back and did a great deal of good work by telling Americans what we were. But we should like to do a great deal more for our Dominion friends, and to get into even closer touch with them than the Americans, and it was no fault of ours that we did not.

Birmingham and South Africa.

He would have liked to have met Mr. Moore when he had visited Birmingham, because no doubt they could have shown him something there which would have entertained him. That would have been proper, because Birmingham had a very close connection with Johannesburg, which was in Mr. Moore's neighbourhood. Many years ago, when the gas engines failed there, and Johannesburg was practically in darkness and without trams, the world was asked who could instal the greatest amount of power there in the quickest time, and a Birmingham firm undertook to instal 1,600 h.p. They had to build a new generating station, boiler house, chimneys, foundations, and everything else, and they only took eight weeks to do it. It was said that it could not be done in six months, but within seven weeks the trams were running.

Technical Co-operation Desirable.

He could speak probably more from the technical than the commercial side, because he was one of the seven who had founded the Institute of British Foundrymen, and was the oldest of its Past-Presidents, two others having, unfortunately, died. Also, as chairman of the Research Committee of the British Cast Iron Research Association, he could say that both those bodies were only too willing to do everything they could to assist our Dominions out of their difficulties. Both bodies were doing excellent work. He was very proud in having been associated with the formation of the Institute of British Foundrymen, because he did not think there was any question that the Americans, who certainly had six years' lead of us, did not do the good, solid work that we did, neither did the American Press give the same good, solid material that our Press did, and he was quite sure that the Canadian gentleman referred to by Mr. Faulkner was speaking the truth when he had said that the literature sent from this country was the finest that could be obtained in Canada in connection with the foundry world. Though he did not wish to discuss politics, he felt that we did not want so much talk in England about doing more work, because we could do it if it were there to be done. It was no good telling a man to work harder if we had only two or three days' work for him to do in a week, and nothing to occupy him for the rest of the week, but if the British Empire were linked up as closely as were the United States of America, we should be busier than they were there, and it would be good for every section of the communities, not only in England, but in all the Colonies. He did not think anyone who studied the problem in America would come back with a different view. We looked at the question of preferences from too narrow a view—from the point of view of England alone.

Presentation to Mr. Moore.

Continuing, Mr. Cook said he had been asked to present to Mr. Moore a little memento to remind him of the happy meetings of British foundrymen with him, and of their desire to be much more closely connected with him in the future than they had been in the past. He hoped that when Mr. Moore returned to South Africa that memento would recall to his mind pleasant memories of his visit to this country. Finally, he expressed the hope that Mr. Moore's journey would be a pleasant one, and that he would enjoy long life and prosperity in South Africa.

The memento, which took the form of a silver ash tray, suitably engraved, and on which was mounted a sword, was then presented to Mr. Moore, amid loud applause.

The toast of Mr. Moore's health, which was then formally proposed by the chairman, was honoured with enthusiasm.

Impression of British Conditions.

MR. MOORE, responding, expressed his thanks for the opportunity which had been given him of meeting those present. Though it had been said that this function was belated, he agreed that it was his own fault, but he appreciated very much the honour of meeting some of the members of the Institute of British Foundrymen and other scientific bodies. He assured his hearers that he would do his utmost in the future to create a closer bond between similar bodies in South Africa and in this country, because he knew that those in England could be and would be of immense value to those in South Africa, who

XUM

were struggling more or less in the dark. He wished also to thank, through those present, all the firms with which he had come into association during his visit for the unfailing courtesy and kindness which they had shown him. They had done a very great deal to make his visit pleasant, and had very ably succeeded. He very much appreciated all that had been done by these firms, and particularly the one with which Mr. Lambert was associated—Messrs. J. Stone and Company, Limited, of Deptford—who had almost put their whole staff at his service, and had attended to all his wants. He had received the same courtesy and kindness in Birmingham, Sheffield and other places, and nothing more could have been done to make his visit a pleasant one.

He had been amazed beyond all measure in London, and had not recognised it as he had known it 22 years ago. He had passed through the industrial areas of this country considerably, and deeply deplored having seen so much unemployment. When he first came he had thought he would try to elucidate the cause of it, but had become more befogged than when he had started. Far more able brains than his own were trying to find a solution for this unemployment, but he considered there was a cancer which was really and truly eating into the heart and vitals and sapping the moral fibre of a great many good Englishmen. That cancer must be removed before we could regain real peace and prosperity in the country. England had been for many centuries the market place of the world, and the British had been the producers for the world. In his opinion, that cancer was what was known as Communism. Looking at it from his Dominion point of view, a very small minority of the people in this country were really and truly ruling the majority of good, sound, thinking, intelligent men. The Communists had got themselves entrenched so securely that they were able practically to intimidate a nation, and they had demanded from the strongest Government which this country had had for many years terms which he personally considered were altogether beyond the pale of reason. He did not wish to enlarge upon it, but it was the impression of an average engineer from the Dominions.

War Work.

Mr. Moore then went on to refer to the pride which South Africans had in the work which England did during the war. If we in this country could only understand how those in the Dominions appreciated the magnitude of the work which was done here, we should possibly have a faint idea of what the Dominions felt towards us. But, further than that, what astounded not only the peoples of the Dominions, but the whole world, was the way in which England had met her liabilities—not altogether her own, but the liabilities of weaker nations, to whom she had allied herself when they were helpless. He was speaking on behalf of people in the Dominions who had not the opportunity of coming here, but they did feel a greater admiration for Englishmen to-day than ever before.

Extent of South African Foundry Industry.

With regard to the extent of the foundry industries in South Africa, he said that they were working practically to rule of thumb there. They had to make shift with all sorts of things, but in this country we had every facility. The latest plant that science could produce, the home founder had at his service. Although in South Africa they had to do many things which would not be done with modern plant, there were quite a number of foundries there. He believed that in the future there would be quite an era of prosperity in the foundry world there, as well as in the other industries, because the slogan throughout the whole of the sub-Continent was that what could be produced in South Africa should be produced there. That was a very sound slogan, and the only way in which a country could prosper was to do all that it could for itself and for other people also, if it could. He believed—and he was speaking very seriously and advisedly—that the foundry industry, with modern practice, and, should he say, strict application to work, would have a good time indeed. He had seen many a small foundry started, and some of them, in the course of time, had gone under, due in a very large measure indeed to want of experience and want of application to work. But there were foundries in South Africa which started 30 years ago, and which were at present very up-to-date. At the same time, they were not so modern as many of them would like them to be, but it was the intention of the more enterprising firms to modernise their plant as far as possible, and, as an earnest of that, they were going to do it themselves.

Technical Co-operation.

Discussing the prospect of the formation in South Africa of a branch of the Institute of British Foundrymen, he said that there existed already a foundrymen's association, in conjunction with the engineers. They had started as a foundrymen's association about eight years ago, but there were so many of the one-man shows in South Africa, and particularly around Johannesburg, that they never seemed to get any cohesion. The smaller man was going to the meetings and agreeing to certain proposals all the time, and at the earliest opportunity would violate every one of the proposals he had spoken on and voted for. No society could exist under those conditions. In consequence, a number of the less reputable firms left the society, but three or four of the stalwarts thought it would be a shame if the society were not continued, even on a smaller scale than previously, and they finally got together those who were really worth having in the society. Further than that, about three years ago the engineering firms—those engineering firms who had no foundry—were invited to join. They did so, and in consequence there is now a fairly good society, known as the Foundrymen's and Engineering Society, of which he was a member. When he returned he would establish a closer alliance between that body and the parent body in this country. He knew that the Institute of British Foundrymen would assist them as far as possible to put their Society on the same lines as their own, because it was bound to have a tendency for good. Being, as they were in South Africa, more or less isolated from the rest of the world, and out of touch with modern practice, he felt that, with the assistance which the Institute could give them, they would, in the course of a few years, make their body a very virile one indeed, and of very great service to the industry throughout South Africa.

South Africa's Foundry Equipment Business.

With regard to foundry equipment, candidly he had experienced all sorts of difficulties in getting anything he had seen advertised in foundry journals, including the FOUNDRY TRADE JOURNAL. It had taken him four months on one occasion to get a barrel of core gum from Liverpool, and he had had a large sheaf of papers dealing with that one barrel. He had come to the conclusion that it was no use wasting time in getting these supplies, but that he would make his own, and he had made quite a lot of things, whereas he was sure it would have been better if he had bought them direct from the specialists in those particular lines. There was not one business in the whole of South Africa dealing extensively in foundry supplies, and he seriously considered that there was room for a concern, with not too big a capital, but with facilities for placing material on the market in a practical way—by that he meant by men who could demonstrate the various foundry appliances and supplies. He personally, and any other enterprising foundryman, would use these things provided they were demonstrated from the practical point of view. Undoubtedly firms should carry stocks in South Africa, and be able to demonstrate them. He had seen many machines in England and Germany which, if put before him without an explanation, he would not recognise as foundry machines. That showed how far behind they were in South Africa in foundry matters, but if there were men to demonstrate the money-making value of these machines, there would be a good market for them.

Natural Resources and Prospects for Skilled Men.

On the question of a British skilled foundryman's prospects of employment in South Africa, he said that the greatest need in South Africa was for more white people. It was a huge country, containing one and a half million white people—English and Dutch—and approximately

seven million blacks. Such a condition of affairs did not tend to prosperity, though there were untold resources. Millions of pounds of gold and diamonds had been extracted, but that was very small in connection with the resources yet untouched. In parts of South Africa—on the Wankies, for instance—there were 400 square miles of coal, but there was no market for it, and that was only one of the coalfields which had not yet been exploited. In the Whitbank and Middleburg areas there was also a very large quantity, but there was only a limited market, and until there were more white people to work them and market them, those resources would lie where they are. What South Africa really wanted was a great influx of intelligent people who were willing and able to work; they wanted men with brains as well as brawn, but with some capital as well. Anybody who went to South Africa with a good scheme, a good marketable proposition for utilising the resources of the country, would be welcomed with open arms. It was the policy of the Government, whichever party be in power, to encourage as far as was humanly possible any intelligent men who could help them to devise ways and means of developing the resources of the country, which were in such great abundance.

Iron and Steel Industry.

He believed the time was not very far distant when they would have an iron and steel industry there, because they had the iron ore in unlimited quantities. They had not only the ore, but the coal and the dolomite, and everything that was necessary for the production of steel, but they had not the capital. They did not want the type that could push a pen, because they already had too many of that calibre, but they wanted men who could and would produce. Their resources included platinum, gold, diamonds, coal, asbestos, mica, and practically everything known to the world, in abundance, and it wanted developing. He himself valued a man's capacity not so much by the money he had as by the capacity he had for producing things and making money, because it was there to be made. He hoped there would be a larger emigration scheme.

If British foundrymen thought kindly of those in South Africa, they would appreciate it. If any of them at any time visited South Africa, he would do all he possibly could to make their visit a pleasant one, and would introduce them to the people he would like them to know.

After dealing with the political outlook in South Africa, Mr. Moore said that the prospect for foundrymen in South Africa who were willing to work should be very bright. It was a wonderful country; there was something in the atmosphere which got into one's blood, and he felt that, when his caravan finally came to rest, it would be in dear, beloved South Africa.

Mr. Faulkner said there was one matter which Mr. Moore had mentioned to him, and which it was advisable to emphasise to a British audience, namely, that if British engineers wished to get plant into South Africa it must be plant which would economise the labour of the skilled man, and not of the common labourer. In calling upon Mr. W. O'Keefe, of the Adaptable Moulding Machine Company, an Australian, to speak, Mr. Faulkner said he thought it was only fitting that the audience should have the views of an Australian on the subject of Empire business.

Mr. O'Keefe, referring to the solution of the unemployment problem in this country by emigration, said he had been in touch that day with a man from Australia who was starting what was called the "Big Brother" movement, for the purpose of assisting young English boys, who were ready to strike out in life, to go to Australia. There each boy was to be met by a big brother, in the form of a grown-up, experienced man, who was established in life, and would be a godfather to him, and responsible for his welfare. The big brother would place the boy into a job, and take a fatherly interest in him if he got into difficulty, and the parents here would feel that there was somebody in Australia to guide the boy. If the boy were not suited to the country, he would be advised to that effect, and arrangements would be made for him to return home. Australians wished to encourage young fellows to go out there, because they wanted to develop their country, just as South Africans did. When boys from this country became successful men in Australia, naturally they had a tendency to come back and to buy products from the Homeland, and that created trade in England. At the same time, the Australians wanted those in England to buy Empire products. If Englishmen did not buy from Australia, Mr. O'Keefe urged them to buy from other British Dominions, because if the Empire spirit were fostered, the unemployment problem in this country would be solved in a very short time. It was a matter of organisation, and he believed that the general public were now beginning to take more interest in the origin of the products they bought, how they were made, and how they affected themselves and the whole community. The Dominions were clamouring for men who would do pioneer work to some extent, although the hard pioneer work in the Dominions had already been done by men such as Mr. Moore. Those early pioneers had surmounted many of the difficulties, and, by their co-operation, life for the newcomers was very much easier.

Foundry Equipment in Australia.

Dealing further with marketing British goods in Australia, Mr. O'Keefe made an interesting and valuable suggestion. He pointed out that the Australian market, from the point of view of an individual firm endeavouring to trade there, was very limited, and he suggested that, instead of one selling organisation specialising in the products of one manufacturer, that selling organisation should deal with the products of many. He had done a good deal in an endeavour to get the Australian markets interested in his own products, but the trouble was that the man who was selling the products was not conversant with the difficulties to be met, with the result that a proposition was often shelved. He urged that there should be technical and practical men on the spot, who could show potential buyers just how to solve the various problems they met with, and could tell them which machine would be best for any particular purpose, and until such organisations as he had suggested were established we should not get very far in catering for the Dominion trade. The distance from Melbourne to Sydney, for instance, was about six hundred miles, and a man could not travel that distance for the purpose of trying to sell equipment to the value of £50 or £100. There were possibilities for good business, however, for foundry equipment suppliers if they could co-operate in one or two sales organisations, so that their representative in Australia would have a reasonable chance of selling their products where they were most needed. Thereby they would help foundrymen in the Dominions, they would foster trade between this country and the Dominions, and bring about a better understanding.

In conclusion, he wished Mr. Moore every success in the future; the gathering that evening would cement great friendships, and those present would, he felt sure, have reason to congratulate themselves later.

Mr. Cook, proposing the toast of "The Chairman," expressed the thanks of all present to Mr. Faulkner for having organised the meeting, and for the very happy way in which he had conducted it. They all knew that everything he took in hand would be done well, but he had excelled himself that evening, and they would all look back upon the event with a very great deal of pleasure.

The toast was honoured with enthusiasm.

Mr. Faulkner, returning thanks, said that these contacts which British foundrymen made with representatives of the Dominions were of such importance that it was incumbent upon him to foster them as much as he could. He had had many ideas given him that evening for putting the position of the Dominions before the foundry public, and he would avail himself of every opportunity to do that. Those in the Dominions would do well to give all the opportunities they could to this country to co-operate with them. He again asked Mr. Moore to do all he could to form a branch of the Institute in South Africa, and thanked him for having given those present the opportunity of doing their little bit towards Empire rapprochement.

XUM

Trade Talk.

NEW PLANT for the manufacture of steel pipes is to be erected at Stockton-on-Tees, near the South Durham Steel & Iron Company's plant.

THE METROPOLITAN CARRIAGE, WAGON AND FINANCE COMPANY, LIMITED, have an order from the South African Railways for 39 first-class and 21 second-class trailer cars.

THE STEEL-FRAMED BUILDINGS, steelwork, joists, angles, channels, etc., in connection with the dismantling of H.M. Gretna factories will be offered for sale by public auction to-day, by Shirlaw, Allan & Company, Hamilton, on behalf of John Jackson & Company (Iron Merchants), Limited, Glasgow.

THE GRINDING OF METALS (MISCELLANEOUS INDUSTRIES) REGULATIONS, 1925, made by the Home Secretary under Section 79 of the Factory and Workshop Act, 1901 (1 Edw. 7, c 22), for the grinding or glazing of metals, or processes incidental to the grinding of metals, or the cleaning of castings, have been issued.

CONTRACT for 230 all steel vestibuled corridor passenger coaches have been divided by the London, Midland and Scottish Railway, between Cammell, Laird & Company, Limited, the Metropolitan Carriage, Wagon and Finance Company, Limited, the Leeds Forge Company, Limited, and the Birmingham Railway Carriage and Wagon Company, Limited.

MR. G. L. TOWNSEND, A.M.I.Struct.E., M.I.E.I., who was formerly associated with Davey & Bell, has established himself in business under the style of Stuart & Grange, inspecting engineers, 35, Bavent Road, Denmark Hill, London, S.E.5. Mr. Townsend, who specialises in billets, sheet and tinplate bars, scrap, etc., has already carried out numerous inspections abroad for British firms, and is at present in Belgium, where a branch of the business will be established in the course of a few weeks.

Contracts Open.

Antwerp, October 19.—30-ton electric travelling crane, for the Antwerp Municipality, Port Equipment Department. The Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. (Ref. No. A.X. 2,380.) (Deposit 50,000 fcs.)

Clacton-on-Sea, October 7.—About 75 tons of cast-iron pipes and specials to British standard specification, Class B, for the U.D.C. Mr. S. Francis, engineer and manager, Gas and Water Department, Clacton-on-Sea.

Dundee, October 3.—Iron, steel, etc., during six months to May 15, 1926, for the Town Council. Mr. G. Baxter, city engineer, 91, Commercial Street, Dundee.

Howrah, India, October 28.—Steam pumping engine, for the municipality of Howrah. Howard Humphreys & Sons, consulting engineers, 28, Victoria Street, Westminster, London, S.W. (Fee Rs. 1,000.)

Johannesburg, October 15.—Steelwork, for the South African Railways and Harbours. The Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. (Ref. A.X. 2,395.)

Lydenburg, S.A., October 16.—Pipes, etc., for the Village Council of Lydenburg, Transvaal. The Department of Overseas Trade, 35, Old Queen Street, London, S.W.1 (reference A.X. 2383).

Manchester, October 7.—10-ton hand-operated overhead travelling crane and gantry, for the Electricity Committee. Mr. H. C. Lamb, manager, Electricity Department, Town Hall, Manchester. (Fee £1 1s., returnable.)

Newton Abbot.—About 10 tons of 6-in. and about 10 tons of 9-in. new or second-hand cast-iron pipes, for the Newton Abbot R.D.C. Mr. S. Olver, highway surveyor, 9, Marlborough Terrace, Bovey Tracey.

Wellington, N.Z., December 8.—Steel supports, for the Secretary, Public Works Tenders Boards, Wellington. The Department of Overseas Trade, 35, Old Queen Street. (Ref. A.X. 2,409.)

A New German Steel Process.—The death of Herr Richard Jonas, who was for a long period managing director of the Freund Iron Smelting and Machine Manufacturing Company, appears to have interrupted a series of experiments he was conducting in connection with a new steel-making process, the patent of which he had purchased from a Swiss inventor. The steel produced is claimed to possess characteristics of an exceptional kind as regards both its physical properties and cost of production. Results of a satisfactory character are said to have attended tests made in the German State Testing Laboratory at Lichterfelde.

Company News.

Hoffmann Manufacturing Company, Limited.—Interim ordinary dividend, 4 per cent., free of tax.

Partington Steel & Iron Company, Limited. — No dividend on ordinary or 6½ per cent. preference shares.

Richard Thomas & Company, Limited.—Half-year's dividend on preference shares, 6½ per cent. per annum, free of tax.

Glasgow Patent Moulders' Blacking Company (1925), Limited, 28, Fleming Street, Glasgow.—Capital £3,000 in £1 shares.

Bruce Peebles & Company, Limited.—Dividend, 7½ per cent. per annum, less tax, on cumulative participating preference shares for half-year.

Ransome and Marles Bearing Company, Limited.—Profit, £32,819; depreciation of plant and premises, £23,975; debenture redemption, £36,000; balance from last year, £24,065; total, £56,884; dividend, 5 per cent., less tax, £15,625; reserve, £10,000; carry forward, £31,259.

A. B. Twist Drill Company, Limited, Bailey Works, Bailey Street, Sheffield.—Capital £3,000 (1,500 £1 6 per cent. cumulative preference, free of income-tax, and 1,500 £1 ordinary). Manufacturers of high-speed and carbon twist drills, etc. Directors: E. C. Strong (chairman) and H. C. Strong.

Thos. W. Ward, Limited.—Credit balance, £119,668; brought forward, £29,313; final dividend on ordinary shares, 6¼ per cent., making 10 per cent. for year, free of tax; final dividend on employees' shares, 5 per cent., making 10 per cent. for year; reserve fund, £10,000; carried forward, £38,274.

Elliott's Metal Company, Limited.—MR. J. ARCHIBALD KENRICK presided at the annual meeting of this company, held at the Grand Hotel, Birmingham, on Monday. In moving the adoption of the report the chairman described the balance-sheet as one of the strongest which had been presented for a good many years. The profit was £10,498 more than in the previous year. The decision to carry forward so large a sum as £49,586 was due to present-day conditions, which were disturbing in regard to the coal industry, the labour situation, and foreign competition. As they looked for cheap fuel, their prosperity was largely bound up in the coal industry. Unless they could have a good settlement for both parties at an early date, they, as manufacturers, must look forward to the future with anxiety. Something must be done to counteract the activities of the irresponsible men in the Labour world. As to foreign competition, there was no doubt Germany was competing with England in an unfair way, both in the home markets and abroad. It was to be hoped people would soon see the necessity of protecting not only home, but imperial markets, because if we were to find employment for those out of work we should have to alter to some extent the policy which had been adopted in the past.

Personal.

MR. A. J. HOY, previously with the Products Corporation, Limited, has joined the staff of the Metal Union, Limited, 66, Broad Street Avenue, E.C.2.

MR. CHARLES M. SCHWAB, chairman of the Bethlehem Steel Corporation, has had the honour of officer of the French Legion of Honour conferred upon him.

MR. H. FOULSTONE, managing director of Needham Bros. & Brown, Limited, ironfounders, of Barnsley, has accepted the Mayoralty of Barnsley for the ensuing year.

MR. F. H. ALLMAN-WARD, after ten years on the Continent, has returned to this country. He has assumed control of the foundries of Henry Watson & Sons, Limited, Walkergate, Newcastle-on-Tyne.

MR. THOS. T. D. GEESIN has been elected to the board of directors of Walter McGee & Son, Limited, engineers, Paisley. Mr. Geesin served his apprenticeship with Clarke, Chapman & Company, Limited, of Newcastle, and afterwards joined the British Thomson-Houston Company, at Rugby, as a member of their staff. He was thereafter engineer and designer to Grice & Anderson (1905), Limited, of Carnoustie, where he carried out several important schemes on their behalf. In 1910 Mr. Geesin again joined the B.T.H. Company at Rugby, and developed the well-known "Fabroil" pinion. On the completion of his war service, Mr. Geesin started on his own as an engineer in London, and represented several companies, including Walter McGee & Son, Limited, Paisley, and Bull Motors, Limited, Ipswich. In February of this year, Mr. Geesin was appointed general manager of Walter McGee & Son, Limited, retaining that position until his election to the board.

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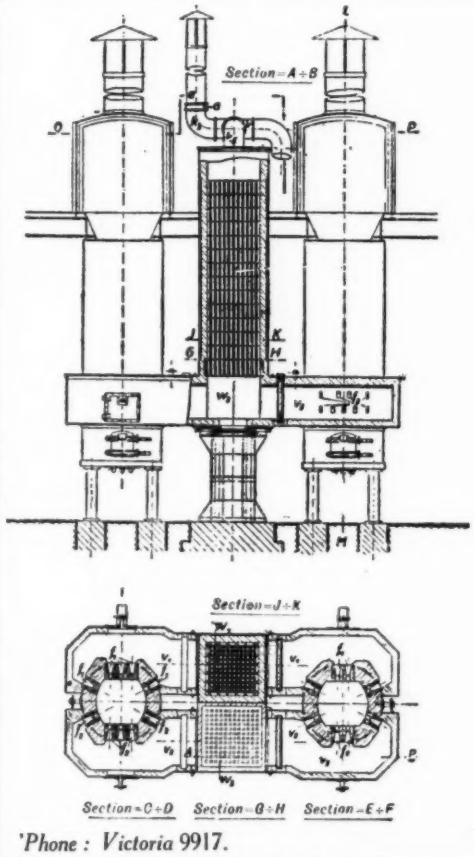

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IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—Conditions in the Cleveland iron trade continue extremely disheartening, the position, in fact, being worse rather than better, and this is reflected in values, which show further weakness. In no direction is it possible to discover any indication of improvement. In the home trade demand is very inactive, and is restricted, as it has been for months past, to small parcels to cover immediate needs. With prices continuously declining, consumers have every inducement to adhere to a hand-to-mouth policy. Business in the export trade is all but negligible, buyers abroad being able to implement their requirements much more cheaply in their own home market. The position all round is extremely disappointing. At this week's market No. 3 G.M.B. was marked down to 67s. per ton; No. 1 was offered at 71s. per ton, No. 4 foundry 66s. 6d., and No. 4 forge 66s. per ton.

In the Tees-side hematite market the home demand is fairly steady, but there is little weight behind it, and certainly barely enough to absorb even the present very limited output. Export business is restricted in the main to small parcels of special analysis. Consequently the quotation for East Coast mixed numbers is weaker, at 74s. per ton, although there are one or two makers not yet prepared to sell at this low figure. For No. 1 quality 74s. 6d. per ton was named. On the North-West Coast Bessemer mixed numbers are still quoted at £4 2s. 6d. c.i.f. Welsh ports, £4 5s. at Glasgow, £4 7s. 6d. at Sheffield, and £4 12s. 6d. at Birmingham.

LANCASHIRE.—Buyers of foundry pig in this district continue the policy of hand-to-mouth transactions, with business again on a very limited scale. The prospect of improvement at the moment appears far from hopeful, and is entirely dependent upon an early revival of the textile machinery industry, which would, of course, bring an increased demand for foundry work. At present the lowest price for any brand of foundry iron here is about 73s. per ton delivered, and some makers of Derbyshire iron refuse orders at under 74s. 6d.

THE MIDLANDS.—In this area also there is no buying on a large scale, the ironfounders being quite content to order small lots from time to time to enable them to carry on. Even the makers of the light castings adopt this policy, although they are pretty well off for work. Current quotations are as follow:—Derbyshire No. 3 foundry, 66s. 6d. to 67s. 6d.; Staffordshire No. 3 foundry, 67s. 6d.; Northants. No. 3 foundry, 61s. to 62s. 6d.

SCOTLAND.—Smelters throughout this area are still making a fight to maintain prices, and quotations for No. 3 Scotch foundry remain at 80s. per ton at the furnaces, but the volume of business passing is exceedingly small, founders being without any confidence as to the future and still very short of orders. Consequently they are not prepared to go beyond their immediate requirements. There has been a little better demand for No. 4 iron on the basis of 80s. at the furnaces, but, generally speaking, the malleable works are exceedingly short of orders, and are not using much pig-iron.

Finished Iron.

Business in most branches of manufactured material is without special features of interest, and few of the works can command sufficient tonnage to ensure full-time operations. Makers of the cheaper irons are still more badly situated, as they can get only a small proportion of the nut and bolt business, on account of the disparity between their price and the French and Belgian offers. The latter works are quoting freely £6 12s. 6d. to £6 17s. 6d. per ton delivered, whereas the lowest Staffordshire figure for bolt iron would be in the region of £11 per ton, and there does not appear to be any prospect whatever of any serious cut being made to lessen the gulf between them. Marked bars are unchanged at £14 10s. per ton at makers' works, and mills manufacturing this and tested iron are fairly well placed for business

Steel.

Reports from the principal centres of the industry are far from encouraging, business continuing on a disappointing scale in most branches, although at Sheffield the demand for acid billets is on a slightly improved scale, but even then the volume of transactions does not amount to much. As to basic billets, there is next to nothing doing, except a little prompt business by users who find foreign billets not quite equal to their particular needs. Open-hearth steel is neglected, and fewer furnaces are in operation than for months past. Railway steel is in weaker request, but motor steel requirements keep up wonderfully well. The amount of business in cold-rolled strip is falling away in this district as the competition becomes keener. Pending some definite agreement of makers on the question of a "pooling scheme," the market for tinplates continues on the quiet side. There has, however, been a fair volume of business passing for I.C. light-weight qualities with the Far East and the Continent, on the basis of from 19s. 3d. to 19s. 4½d., f.o.b. works port.

Scrap.

No change for the better can yet be reported in the scrap metal trade, and as far as concerns demand for foundry material, buying has dwindled to almost negligible proportions. In Lancashire, for example, there is only a quiet demand from the foundries at 70s. per ton for ordinary broken machinery castings, but dealers usually quote 72s. 6d. for this class of metal. As common pig-iron is still dearer than 72s. 6d. dealers argue that machinery scrap ought to be worth more; but for years ironfounders have been able to buy scrap at 5s., and even 10s., below the price of No. 3 pig, and they do not want to abandon this privilege. There is still a scarcity of fine, "textile" machinery scrap, and special prices up to 80s. per ton are wanted for it. In Scotland machinery cast-iron scrap is unchanged at 71s. 6d. to 72s. 6d. per ton, while ordinary qualities are on offer at 67s. 6d. per ton, delivered f.o.t. at consumers' works.

Metals.

Copper.—Movements in standard copper of late have been without any very marked fluctuations in values, the tone of the market on the whole continuing fairly firm and steady. More recently there has been some fair buying of intermediate dates, but there is nothing in the immediate outlook to give cause for marked optimism, as developments depend to a large extent on possibilities of a revival in Continental buying. It is recognised over here that American consumers have already made ample provision for autumn needs. Current quotations:—*Cash*: Thursday, £61 7s. 6d.; Friday, £61 7s. 6d.; Monday, £61 2s. 6d.; Tuesday, £61 5s.; Wednesday, £61 2s. 6d.

Three Months: Thursday, £62 5s.; Friday, £62 5s.; Monday, £62 2s. 6d.; Tuesday, £62 2s. 6d.; Wednesday, £62.

Tin.—Influenced by favourable Eastern advices, an active business has been done in London at steadily advancing prices, particularly forward, there being a notable lack of selling pressure, while stocks of the metal, both here and in Liverpool, are on a much smaller scale. Sentiment has been to some extent strengthened by the considerably reduced estimates of Straits shipments for the current month, varying from 4,500 to 5,000 tons, and America having given indications of renewed interest, there is a more optimistic feeling as to future developments. Current quotations:—*Cash*: Thursday, £264 10s.; Friday, £263 7s. 6d.; Monday, £264 10s.; Tuesday, £264 17s. 6d.; Wednesday, £266 10s.

Three Months: Thursday, £264 10s.; Friday, £263 10s.; Monday, £264 15s.; Tuesday, £265 7s. 6d.; Wednesday, £267.

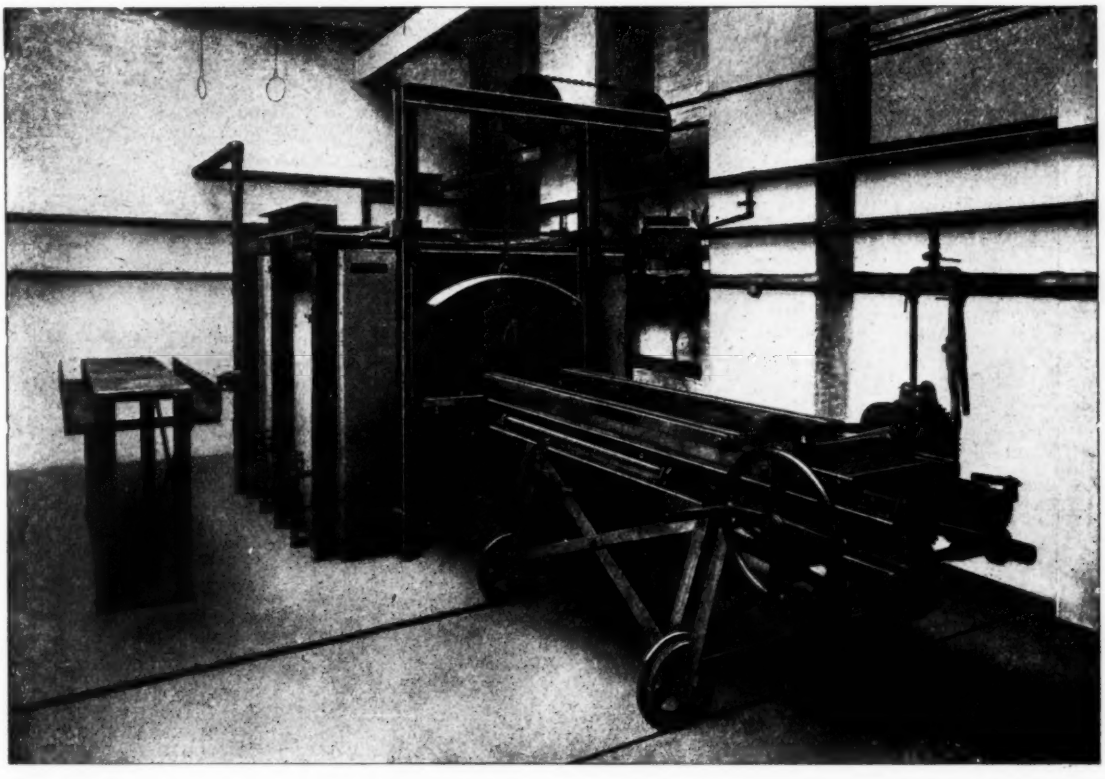
Spelter.—Largely as a result of the stronger American cables received here, greater firmness has been experienced in the zinc market. Demand on the part of consumers has slightly improved, and buying generally has been on a more liberal scale, a wider interest being taken in forward deliveries. *Ordinary*: Thursday, £38 12s. 6d.; Friday, £38 11s. 3d.; Monday, £38 6s. 3d.; Tuesday, £38 7s. 6d.; Wednesday, £38 12s. 6d.

Electro, 99.9: Thursday, £43; Friday, £43; Monday, £42 15s.; Tuesday, £42 5s.; Wednesday, £42 15s.

Lead.—The lead situation is now becoming more interesting, a striking feature of the market being the renewed rapid rise in the price on a more intense general demand. The scarcity of supplies on the spot and for early arrival is becoming accentuated to a point which is causing no little concern to the legitimate trade under a much heavier consumption. *Soft foreign (prompt)*: Thursday, £39 5s.; Friday, £39 12s. 6d.; Monday, £39 10s.; Tuesday, £39 7s. 6d.; Wednesday, £39 12s. 6d.

English: Thursday, £40 15s.; Friday, £40 15s.; Monday, £40 15s.; Tuesday, £40 10s.; Wednesday, £40 10s.

HEAT TREATMENT UNDER IDEAL CONDITIONS



GIBBONS'S NEW PATENT
REGENERATIVE GAS FURNACE AND
PATENT FURNACE CHARGING MACHINE

REDUCE ANNEALING & CARBURIZING **COSTS**

Illustrated Lists and Full Particulars from:

Gibbons Bros. Ltd., Dibdale Works, DUDLEY, Worcs.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	61	2	6
Three months	62	0	0
Electrolytic	66	10	0
Tough	63	7	6
Best selected	63	17	6
Sheets	92	0	0
India	79	0	0
Wire bars	67	5	0
Do. Oct.	67	2	6
Do. Oct.–Nov.	67	5	0
Ingot bars	67	2	6
H.C. wire rods	71	10	0
Off. av. cash, Aug.	62	13	6
Do., 3 mnths. Aug.	63	13	0
Do., Sttlmnt, Aug.	62	13	4½
Do., Electro, Aug.	68	7	9
Do., B.S., Aug.	66	3	1½
Aver. spot price copper, Aug.	62	13	4½
Do., wire bars, Aug.	68	12	1½
Solid drawn tubes			13½d.
Brazed tubes			13½d.
Wire			10d.

BRASS.

Solid drawn tubes	12d.
Brazed tubes	13½d.
Rods, drawn	11½d.
Rods, extd. or rlld.	7½d.
Sheets to 10 w.g	10½d.
Wire	10½d.
Rolled metal	9½d.
Yellow metal rods	7½d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets	8½d.

TIN.

	£	s.	d.
Standard cash	266	10	0
Three months	267	0	0
English	266	10	0
Bars	267	0	0
Straits	272	7	6
Australian	268	10	0
Eastern	271	0	0
Banca	272	2	6
Off.aver.cash, Aug.	258	12	8½
Do., 3 mths., Aug.	258	6	6¾
Do., Sttlmt. Aug.	258	13	0
Aver. spot., Aug.	258	13	0

SP ELTER.

	£	s.	d.
Ordinary	38	12	6
Remelted	37	5	0
Hard	31	10	0
Electro 99.9	42	15	0
English	38	15	0
India	32	10	0
Zinc dust	44	0	0
Zinc ashes	15	0	0
Off. aver., Aug.	36	9	1½
Aver., spot, Aug.	36	13	9

LEAD.

	£	s.	d.
Soft foreign ppt.	39	12	6
English	40	10	0
Off. average, Aug.	37	8	4½
Average spot, Aug.	38	3	9

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	44	0	0
Do. V.M. ex whf.	43	0	0
Rods	49	0	0
Boiler plates	42	0	0
Battery plates	42	0	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	74	10	0
Chinese	66	10	0
Crude	61	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	12	17	6

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro silicon 45/50%	£12 12 6
Ferro silicon 75%	£21 0 0
Ferro-vanadium—35/40%	16/- lb. va.
Ferro-molybdenum—70/75% c. free	6/3 lb.
Ferro-titanium—23/25% carbonless	1/1 lb.
Ferro-phosphorus, 20/25%	£22 0 0
Ferro-tungsten—80/85%, c.fr.	1/8 to 1/8½ lb.
Tungsten metal powder—98/99%	1/11 to 1/11½ lb.
Ferro-chrome—4/6% car.	£23 15 0
Ferro-chrome—6/8% car.	£22 17 6
Ferro-chrome—8/10% car.	£22 10 0
Ferro-chrome—Max. 2% car.	£39 15 0
Ferro-chrome—Max. 1% car.	£51 12 6
Ferro-chrome—Max.0.70% car.	£55 17 6
Ferro-chrome—70%, carbonless	1/5 lb.
Nickel—99%, cubes or pellets	£170 to £175
Cobalt metal—98/99%	10/- lb.
Aluminium 98/99%	£120
Metallic Chromium—96/98%	3/9 lb.
Ferro-manganese (net)—76/80%, loose	£15 7 6
Ferro-manganese (net)—76/80%, packed	£16 7 6
Ferro-manganese (net)—76/80%, export	£15 5 0
Metallic manganese—94/96%, carbonless	2/- lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

	s.	d.
Finished bars, 14% tungsten	2	6
Finished bars, 18% tungsten	3	0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares 3 in. and over	4d. lb.
Rounds and squares under ½ in. to ¼ in.	3d. lb.
Do. under ¼ in. to ⅜ in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do. under ½ in. × ¼ in.	1/- lb
Bevels of approved sizes and sections	6d. lb.
Bars cut to length	10% extra
Scrap from high-speed tool steel—Scrap pieces	3d.
Turningds and warf	1d.

Per lb. net, d/s steel makers' work

SCRAP.

	£	s.	d.	£	s.	d.
South Wales—						
Hvy. steel	3	7	6	to 3	10	0
Bundled steel & shrngs.	3	2	0	to 3	6	0
Mixed iron & steel	3	0	0	to 3	2	6
Heavy cast iron				3	6	0
Good machinery for foundries				3	10	0
Cleveland—						
Heavy steel				2	17	6
Steel turnings				1	17	6
Cast iron borings				1	15	0
Heavy forge				4	0	0
Bushelled scrap				3	5	0
Cast-iron scrap				3	5	0 to 3 10 0
Lancashire—						
Cast-iron scrap				3	10	0 to 3 12 6
Heavy wrought				3	5	0 to 3 7 6
Steel turnings				2	3	0

London — Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	53	0	0
Brass (clean)	40	0	0
Lead (less usual draft)	33	10	0
Tea lead	31	10	0
Zinc	25	0	0
New aluminium cuttings	92	0	0
Braziery copper	48	0	0
Gunmetal	48	0	0
Hollow pewter	180	0	0
Shaped black pewter	130	0	0

PIG-IRON.

(*f.o.t. unless otherwise stated*).

N.E. Coast—	
Foundry No. 1	71/-
Foundry No. 3	67/-
Foundry No. 4	66/6
Forge No. 4	66/-
Hematite No. 1	74/6
Hematite M/Nos.	74/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	84/-
,, d/d Birm.	92/6
Midlands—	
Staffs. common*	—
,, No. 4 forge	67/6
,, No. 3 foundry	69/-
Shrops. basic	70/-
,, Cold blast, ord.*	185/-
,, ,, roll iron*	190/-
* d/d Birmingham.	
Northants forge	57/6
,, fdry No. 3	62/-
Derbyshire forge	59/6
,, fdry. No. 3	66/3
,, basic	67/6
Scotland—	
Foundry No. 1	85/-
,, No. 3	80/-
Hem. M/Nos.	80/-
Sheffield (d/d district)—	
Derby forge	63/3
,, fdry. No. 3	70/6
Lincs. forge	69/-
,, fdry. No. 3	72/-
E.C. hematite	84/6
W.C. hematite	87/-
Lincs. (at furnaces)—	
Forge No. 4	63/-
Foundry No. 3	66/-
Basic	63/6
Lancashire (d/d eq. Man.)—	
Derby forge	67/-
,, fdry. No. 3	74/-
Northants foundry No. 3	75/-
Dalzell, No. 3	110/-
Summerlee, No. 3	97/6
Glengarnock, No. 3	97/6
Gartsherrie, No. 3	97/6
Monkland No. 3	97/6
Coltness, No. 3	97/6
Shotts, No. 3	97/6

FINISHED IRON & STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars(cr.)	11	12	6	to 12	10	0
Angles				12	7	6
Tees to 3 united ins.				13	2	6
Nut and bolt				11	0	0
Hoops	14	0	0	to 15	0	0
Marked bars (Staffs.) f.o.t.				14	10	0
Gas strip				12	15	0
Bolts and nuts ¾ in. × 4 in.				16	15	0
Steel—						
Ship plates	8	0	0	to 8	15	0
Boiler plts.				12	0	0
Chequer plts.	£9	15	0	to 10	5	0
Angles	£7	12	6	to 8	0	0
Tees	£8	12	6	to 9	0	0
Channels	£7	5	0	to 7	15	0
Joists	£7	12	6	to 8	0	0
Rounds and Squares 3 in. to 5½ ins.				9	0	0
Rounds under 3 in. to ¾ in.				8	15	0
Flats, over 5 in. wide and up				9	10	0
Flats, 5in. to 1½in.				8	10	0
Rails, heavy				8	10	0
Fishplates				12	10	0
Hoops (Staffs.)				10	10	0
Black sheets, 24g.				11	5	0
Galv. cor. sheets, 24g.				16	5	0
Galv. fencing wire 8g. plain				14	0	0
Billets, soft	£6	5	0	to 7	15	0
Billets, hard				9	0	0
Sheet bars	£6	5	0	to 6	15	0
Tin bars d/d	£6	5	0	to 6	15	0

PHOSPHOR BRONZE.

	Per lb.	basis.
Strip	1	3
Sheet to w.g.	1	3½
Wire	1	3½
Rods	1	3
Tubes	1	8
Castings	1	2

Delivery 3 cwt. free

10% phos. cop. £40 above B.S.

15% phos. cop. £50 above B.S.

Phosphor tin (5%) £30 above price of English ingots.

C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—3/0 to 10 G.	1/6½ to 2/1½

with extras according to gauge.

AMERICAN IRON & STEEL.

At Pittsburgh unless otherwis. stated.

	Dolse
No. 2X foundry, Phila.	21.76
No. 2 foundry, Valley	20.76
No. 2 foundry, Birm.	18.50
Basic	20.26
Bessemer	21.26
Malleable	20.76
Grey forge	20.26
Ferro-mang. 80% d/d	115.00
Bess. rails, h'y, at mill	43.00
O.-h. rails, h'y at mill	43.00
Bess billets	35.00
O.-h. billets	35.00
O.-h. sheet bars	35.00
Wire rods	45.00

	Cents.
Iron bars, Phila.	2.12
Steel bars	1.90
Tank plates	1.80
Beams, etc.	1.90
Skelp, grooved steel	1.90
Skelp, sheared steel	1.90
Steel hoops	2.40
Sheets, black, No. 28.	3.15
Sheets, galv., No. 28	4.20
Sheets, blue an'l'd, 9 & 10	2.25
Wire nails	2.65
Plain wire	2.50
Barbed wire, galv.	3.35
Tinplate, 100 lb. box	£5.50

COKE (at ovens).

Welsh foundry	37/6
,, furnace	27/6
Durham & North. ,, foundry	35/-
,, furnace	14/6
Other Districts, foundry	35/-
,, ,, furnace (Basis)	13/6

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes,	20×14, box	19/4½
,,	28×20, ,,	38/9
,,	20×10, ,,	28/1½
,,	18¾×14, ,,	20/4½
C.W.	20×14, ,,	17/10½
,,	28×20, ,,	35/9
,,	20×10,	25/1½
,,	18¾×14, ,,	18/7½

Terneplates 28×20, 36/3 per box basis f.o.b.

SWEDISH IRON.

Bars, hammered	£19/0 to £20/0
Rolled Ord.	£16/0/0 to £16/10/0
Nail rods	£16 5 0 to £16 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£10 to £14
Pig-iron	£6 15 0 to £7 0 0

all f.o.b. Gothenburg.

TUBES.

	Up to and incl. 6 in.
Gas ..	55% Tube prices
Water ..	50% are
Steam ..	45% now free.

DAILY FLUCTUATIONS.

Standard Copper (Cash).

	£	s.	d.	
Sept. 24	61	7	6	dec. 2/6
„ 25	61	7	6	No change
„ 28	61	2	6	dec. 5/–
„ 29	61	5	0	inc. 2/6
„ 30	61	2	6	dec. 2/6

Electrolytic Copper.

	£	s.	d.	
Sept. 24	67	5	0	dec. 5/–
„ 25	67	5	0	No change
„ 28	67	0	0	dec. 5/–
„ 29	66	15	0	„ 5/–
„ 30	66	10	0	„ 5/–

Standard Tin (Cash).

	£	s.	d.	
Sept. 24	264	10	0	dec. 5/–
„ 25	263	7	6	„ 22/6
„ 28	264	10	0	inc. 22/6
„ 29	264	17	6	„ 7/6
„ 30	266	10	0	„ 32/6

Tin (English ingots).

	£	s.	d.	
Sept. 24	264	15	0	inc. 10/–
„ 25	263	10	0	dec. 25/–
„ 28	264	15	0	inc. 25/–
„ 29	265	0	0	„ 5/–
„ 30	266	10	0	„ 30/–

Zinc Sheets (English).

	£	s.	d.	
Sept. 24	43	10	0	No change
„ 25	44	0	0	inc. 10/–
„ 28	44	0	0	No change
„ 29	44	0	0	„ „
„ 30	44	0	0	„ „

Spelter (ordinary).

	£	s.	d.	
Sept. 24	38	12	6	inc. 7/6
„ 25	38	11	3	dec. 1/3
„ 8	38	6	3	„ 5/–
„ 29	38	7	6	inc. 1/3
„ 30	38	12	6	„ 5/–

Lead (English).

	£	s.	d.	
Sept. 24	40	15	0	dec. 5/–
„ 25	40	15	0	No change
„ 28	40	15	0	„ „
„ 29	40	10	0	dec. 5/–
„ 30	40	10	0	No change

Sweden.—Imports of Iron and Steel.

Year.	Pig-iron.	Joists, angles, etc.	Plates and sheets.	Tinplates.	Rails.	Pipes and tubes.	Unenumerated.	Total.
	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.
1913	94,600	49,600	16,600	8,500	58,000	27,400	—	254,700
1914	103,200	46,300	16,700	5,900	52,700	23,800	—	248,600
1915	111,400	59,500	26,900	5,400	23,400	24,300	—	250,900
1916	92,500	88,500	41,300	5,200	34,300	30,900	—	292,700
1917	42,800	20,900	15,900	200	1,600	16,500	—	97,900
1918	18,111	36,800	16,412	218	21,419	13,423	—	100,383
1919	29,501	22,200	24,517	7,118	33,589	13,989	—	130,914
1920	37,454	66,631	48,721	7,788	58,952	28,252	—	247,798
1921	11,251	33,732	24,334	3,300	42,371	13,340	—	128,328
1922	21,403	41,782	14,381	7,300	26,648	27,555	—	139,069
1923	34,900	60,700	39,700	7,900	12,100	31,000	1,500	187,800
1924	44,000	90,100	37,200	8,400	79,200	30,700	1,400	291,000

Sweden.—Exports of Iron and Steel.

Year.	Pig-iron and ferro.	Blooms and billets.	Wire rods.	W.I. bars.	Tubes and tube blanks.	Unenumerated	Total.
	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.	Metric tons.
1913	186,100	54,800	—	—	—	261,700	502,600
1914	162,800	35,900	—	—	—	184,100	382,800
1915	290,200	55,300	—	—	—	243,400	588,900
1916	227,000	65,900	—	—	—	270,200	560,100
1917	231,200	51,200	—	—	—	205,200	487,600
1918	194,111	34,134	32,155	69,229	7,470	8,910	348,485
1919	89,072	13,728	19,408	70,264	9,525	5,183	210,392
1920	125,520	12,999	13,831	67,101	11,937	9,165	245,233
1921	88,387	4,122	6,478	26,632	3,249	3,262	133,726
1922	53,032	14,679	12,412	44,185	7,242	4,744	140,938
1923	115,900	11,700	14,200	46,000	6,500	38,600	232,900
1924	104,600	13,700	21,200	69,600	21,500	32,000	262,600

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.

18, BENNETTS HILL, BIRMINGHAM.
11, OLD HALL STREET, LIVERPOOL.
EXCHANGE BLDGS., PORT TALBOT.
FOWLERS BUILDINGS, BOMBAY.
CLIVE STREET, CALCUTTA.
ANGAPPA NAICK STREET, MADRAS.

REGISTERED TRADE MARK

1, HONG KONG ROAD, SHANGHAI.
OCEAN BUILDING, SINGAPORE.
JAVA STREET, KUALA LUMPUR
5, SHAFFRAZ ROAD, RANGOON.
COX'S BUILDINGS, KARACHI.
P.O. BOX 1580, CAIRO.

PIG IRON

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.,

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM COLVIN & COMPANY,

ROYAL EXCHANGE, MIDDLESBROUGH.

93, HOPE STREET, GLASGOW.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 7 words per line. Minimum charge for one insertion 3/-.

SITUATIONS VACANT AND WANTED.

CHEMIST, METALLURGICAL, wanted for an Iron Foundry, doing all kinds of marine engine castings; state age, experience and wages expected, when at liberty; give references.—Box 480, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

FOREMAN MOULDER WANTED, used to Sand and Loam Castings up to 30 tons; must be conversant with Modern Foundry Methods and able to organise and control labour.—State age, experience and salary required to Box 466, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

FOREMAN required for Foundry in Sussex; must be practical man, capable of making own pattern plates. Knowledge of moulding machines essential. Only live man capable of obtaining utmost output need apply. State experience and wages required.—Box 486, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

FOUNDRY FOREMAN, age 45, requires position; practical knowledge of Dry and Green Sand Castings; also experienced with Jar-ram and Squeezing Machines.—Box W. A. G., Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2

FOREMAN MOULDER, Brass or Iron, seeks position; age 43 years; 15 years' experience as Foreman Moulder; Marine, Oil Engines, Hydraulic, Textile, Railroad, Crane and Mining Work; willing to go anywhere.—Box 468, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

FOUNDRY FOREMAN, disengaged, desires position; 22 years' experience; Engineering and Jobbing work; mix Grey Iron, Semi-steel, Non-ferrous Metals by analysis; can get maximum production and take charge of pattern shop.—Box 472, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C.2.

FOUNDRY TRADE TRAVELLER; disengaged; thoroughly practical in all branches of the Foundry Trade; member I.B.F.; connection Lancashire; age 34.—Box 458, Offices of The Foundry Trade Journal, Bessemer House, 5, Duke Street, Adelphi, London, W.C 2.

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